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Muzzling the British Ox.

The "Iron and Coal Trades Review," London, in a recent issue tells how the British ox is muzzled and how, as it claims, the British Government is doing the muzzling. The trouble is all about the South African contracts recently awarded to American manufacturers. There seems to be an idea prevalent that "as Great Britain has expended so much blood and treasure over the present war, she has a conqueror's right to any pickings that may result from her victory, and that this right should not be interfered with by any of the ordinary considerations of economy, quality, or otherwise, which determine the placing of contracts." Of course the government, like the individual, should generally buy in the cheapest market, "but the conditions in this case are altogether extraordinary, both because of the recent events connected with the war, and because of the special economic circumstances under which the American manufacturers carry on their operations."

"We may at once be frank enough to avow that, in our opinion, there is a great deal too much partiality for foreign productions on the part of both the War Office and the Admiralty. It is an open secret that for years past foreign machinery has been imported to a considerable extent into the government workshops and arsenals. In the government explosives factories, practically the whole of the machinery used is of German origin. In the small-arms factories, the United States, German and Belgian manufacturers are represented to a much larger extent than is agreeable. The government or War Office official, as a rule, is only concerned to buy in the cheapest market."

This is "muzzling the ox that treadeth out the corn," which you shouldn't do, you know. As the British, and not we, are in this the sinners it is not for us to do penance for it.

But it is complained that the United States and Germany are not fair in their competition, because they each have protective tariffs ranging from 20 to 100 per cent. *ad val.* against the foreigners. "The British manufacturer, on the contrary, enjoys no protection of any kind, and must make every contract he enters into pay its own way." But when he buys American trucks because he can get them both cheaper and quicker he has to take a scolding.

"It is conceivable that the American or some other nation may, by the aid of superior natural resources, and a craftily-contrived economic system, make it practically impossible for British manufacturers to secure any orders in foreign markets—nay, make it doubtful whether we could rely on getting any orders in our own. In such a case the great iron and steel industries of the United Kingdom would cease to be, and, with the passing of our iron industries, our mechanical supremacy in many other directions would be certain to disappear. Would any government dare to be a party to such a state of things? If not, why should the government connive at conditions that make for such a crisis, as they appear to be doing at the present time? It is certain that no foreign government would do so, because it is the rarest of rare things to find any foreign government orders being placed in Great Britain under any circumstances."

It is not for us to suggest what should be done. From our point of view, it would seem to be best for us to continue to make and sell as cheaply as possible, even though our customers while still buying do also whine because our things are not dearer. We are not likely to sell much for less than cost for the sake of muzzling any ox, and it will be hard to convince any but British manufacturers immediately concerned that America is hurting Britain by supplying her other manufacturers and workmen with good and cheap tools with which to carry on industrial operations.

The New "Force."

Our esteemed contemporary, "The Age of Steel," has discovered a "New Force in the Mechanical World," and announces it in a leading editorial bearing the above quoted title. The new "force" is liquid air, concerning which we are told that, "It has been found economical and efficient in the propulsion of automobile carriages and wagons and vehicles of all kinds. For refrigerating purposes it can be used in the transportation of perishable goods on land and sea, and for store and domestic uses it has advantages that even the ice man concedes are indisputable. It can be used as an explosive in the place of dynamite, and with a minimum of hazard. In the manufacture of paints, drugs and chemicals it is of valuable service, and in medicine and surgery it is being increasingly appreciated." As far as we are informed, not one item of the above is true, except possibly the last one. The economical use of liquid air either for power application or for refrigeration is not in sight. At the recent automobile exhibition in this city a vehicle was exhibited driven by liquid air. The fact that it would go proved nothing. In this automobile no effort seems to have been made to make as good a show as possible for the air, as its efficiency might have been doubled by the use of a simple heating device for the re-expanded air before it entered the engine cylinders. The claims made as to the miles of travel of the machine for a given weight of liquid air consumed were somewhat lower than computed as possible by Frank Richards in our columns last year. We are not informed that the production of liquid air has yet been brought to a settled commercial basis, so that it has a determined market price per gallon, and so that it can

be unfailingly supplied as demanded. At the automobile show the liquid-air machine stood motionless for several days because the liquid could not be furnished to run it. When we are sure of getting the liquid air and know precisely what we must pay for it, it will be soon enough to begin any reliable computations concerning it, and in the meantime the influence of our contemporary, so far as it goes in engineering matters, will tend only to help liquid-air promoters to get money from the public without rendering anything like an equivalent value in return.

Elsewhere in this issue we publish a letter signed "Alonzo," the author of which, though he is not now connected with the navy, is so situated as to make it inadvisable for him to reveal his identity. Nevertheless, his experience has been such as to make him thoroughly competent to discuss naval matters, and we know that he has the real interest of the navy at heart. The statements we quoted, and which we referred to, seem all right upon their face, and we gave "Navy" credit for being sincere and for having no ulterior object in view in writing as he did. Former experience should have taught us, however, that this is never safe in connection with naval matters. There is a clique there which seeks always and everywhere to advance the interests of its own members and which does not hesitate to resort to very unfair means to accomplish its ends. According to "Alonzo," we have been dealing with such a case.

Meeting of the Mechanical Engineers.

The full program has been issued for the annual meeting in this city of the American Society of Mechanical Engineers, December 4-7.

The first meeting will be on Tuesday evening at the house of the society, 12 West Thirty-first street. At 9 o'clock the president of the society, Mr. Charles H. Morgan, will deliver his annual address. A light luncheon will be served later, followed by a "smoker."

On Wednesday morning will be held the annual business meeting, followed by the reading of the following papers: "Comparison of Rules for Calculating the Strength of Steam Boilers," H. De B. Parsons; "A Record of the Early Period of High-Speed Engineering," Chas. T. Porter; "Steam Engine of Maximum Simplicity and of Highest Thermal Efficiency," Robt. H. Thurston. Luncheon will be served after the meeting.

At the Wednesday evening session the following papers will be read: "Notes on Centrifugal Fans for Cupolas and Forges," Wm. Sangster; "Power Plant of the Massachusetts General Hospital," F. W. Dean; "The Construction of Contracts," Reginald P. Bolton; "An American Central Valve Engine," E. T. Adams.

The Thursday morning session will be an attractive departure from the usual routine. The council has accepted an invitation from the president of Columbia University that on that day the society should be the guests of that institution at 10.30. The session for papers will be held in the large lecture room (No. 309) of Havemeyer Hall of the university buildings. After adjournment, and before luncheon, President Low will receive the members and their guests in the trustees' room of the library building. Lunch will be served in room No. 301 of the engineering building at 1 o'clock.

After luncheon the mechanical laboratories will be inspected, with the locomotive "Columbia" in running condition, as well as the Allis experimental engine. The power-house, the shops, the museums, drawing rooms and all the other features of the university plant will be open for visitors. Mr. Wheeler's paper will be illustrated by a working example. Lady visitors will be particularly interested in the library and in the artistic work of the department of architecture.

The following are the papers to be presented at the session of Thursday: "Mechanical Integrator Used in Connection with a Spring Dynamometer," Max H. Wickhorst; "Apparatus for Dynamically Testing Steam Engine Indicators," Carleton A. Read; "Tests of the Boilers of the Purdue Locomotive," W. F. M. Goss; "A New Recording Air Pyrometer," W. H. Bristol; "Comparative Value of Different Arrangements of Suction Air Chambers on Pumps," F. Meriam Wheeler.

On Thursday evening, at Sherry's, will be held the formal reception of members and guests by the president and president-elect, at 9 o'clock.

The closing session will be on Friday morning, with the presentation of the following papers: "Tests of Centrifugal Pumps," W. B. Gregory; "Hardness, or the Workability of Metals," Wm. J. Keep; "New Principle of Gas Engine Design," Chas. E. Sargent; "Heat Efficiency of the Gas Engine as Modified by Point of Ignition," C. V. Kerr; "Power and Light for the Machine Shop and Foundry," Forrest R. Jones.

Insurance Against Strikes in Austria

A report from Trieste, Austria, by Consul Frederick W. Hossfeld to the State Department is as follows: "A number of Austrian manufacturers have recently formed an association for insurance against strikes. It is the object of the association to indemnify its several members for all losses sustained by them from unjust strikes which may break out in their respective establishments, whether voluntary, sympathetic or forced. Each member is to pay a weekly premium equal to from 3 to 4 per cent. of the amount of his pay roll. The indemnity to be paid to him in case of a strike is to be, tentatively, 50 per cent. of the wages paid to his employees for the week next preceding the suspension of work. It is provided, however, that no indemnity shall be paid if a committee of confidential agents appointed by the association shall, after a full investigation of all the circumstances, find the strike a justifiable one. It is worthy of note that a report upon and discussion of the subject 'Insurance Against Strikes' forms a prominent feature of the program of the national convention of Austrian manufacturers, to be held this month. It appears that this movement of industrial employers is not confined to Austria. It is reported that a similar insurance association, though on a smaller scale, has been organized in Leipzig. Both the Austrian and German associations, it appears, recognize in principle the justness of strikes; which is, at least in this country, an important concession to labor. Whether this recognition will have any practical result remains for the present a matter of conjecture."

Drawback on Exports.

Under existing United States revenue laws, a drawback, or rebate, is allowed in the exportation of manufactured goods made wholly or in part from foreign materials, equal to 99 per cent. of the duty paid on the materials used, provided that the foreign materials shall so appear in the completed articles that the quantity or measure thereof may be ascertained. It seems that manufacturers of some kinds of machinery have been in a position to take advantage of this provision, drawbacks having recently been allowed on the following articles, among others: Automatic air brakes, axles, bicycles, brass tubes, electrical material, nails, sewing machines and cutlery. The arrangement is especially advantageous when, as has happened in late years, European engineers in charge of the construction and equipment of foreign railways, bridges, mines, factories, etc., have endeavored to handicap American manufacturers by inserting in the specifications the condition that the materials must be of English, German, French or Russian production, with a view of increasing the cost of such materials through the payment of American duties. In many instances large amounts of drawback have been collected on foreign materials specified by engineers for the express purpose of preventing Americans from getting the contracts. These facts are stated upon the authority of a little book sent us by Allen, Comstock & Co., 11 William street, New York, who are agents for the collection of such drawbacks.

A steel shaft in a hoisting engine of the Anaconda Copper Mining Company, Anaconda, Mont., recently broke and caused a shut-down till a new one could be pro-

cured. An order was given to the Bethlehem Steel Company, which took the new shaft in hand under emergency conditions, and machine finished it complete within fourteen days from receipt of the order, this being two days earlier than required by the contract. It was a hollow-forged, fluid-compressed steel shaft, 17 feet 10 inches long and 15¾ inches in diameter, with a 7-inch axial hole, and weighing about 12,000 pounds. As soon as ready, it was shipped to Anaconda by express in a special car.

In our description of the Walker Magnetic Chuck at page 1089, we intended to say that the chucks are made by O. S. Walker & Co., Worcester, Mass.

Legal Notes.

BY WM. MARSTON SEABURY.

FIXING RESPONSIBILITY FOR ACCIDENT WHERE TWO COMPANIES WERE WORKING TOGETHER.

Thomas Moren was employed by the Chicago Edison Company as a common laborer, and while so employed received injuries which caused his death. The Chicago Edison Company engaged the Merchants' Transfer Company to remove a certain boiler which weighed from 26,000 to 28,000 pounds. By the terms of the contract between the two companies the transfer company had the exclusive right to determine the manner of removal of the boiler and the machinery and appliances to be used in the work, while the Edison company was to assume the exclusive control of removing the brick foundation upon which the boiler had stood. A gang of men under the foreman of the transfer company began the work of hoisting the boiler in the usual way and by means of the usual appliances. Two ¾-inch chains were used and each chain was wrapped twice around each drum of the boiler. The chains, according to the estimate, were capable of supporting a weight of 29,000 pounds used singly, and twice that weight when used in the manner indicated. Just as the boiler was about to be hoisted, the treasurer of the transfer company, who had supervision of the work, told the foreman of the Edison company that he had better take his men from under the boiler until it should be hoisted and blocked up. This the foreman did, but when it was hoisted the transfer company's foreman with some men got on top of it and swung, surged and tested it and said it was all right. Thereupon Moren was ordered under the boiler, and in about five or ten minutes the chain broke and the boiler fell, crushing Moren to death. Moren's administratrix brought suit against his employers, the Edison company, to recover damages, and at the trial the court refused to direct the jury to render a verdict for the defendant, and from the judgment in the plaintiff's favor the defendant appealed. The Supreme Court of Illinois affirmed the judgment of the lower court, and in refusing to hold that the liability for the injury rested upon the transfer company and not upon the Edison company the court said: "That company had a contract with appellant (the Edison company) to move the boiler, but it had nothing to do with the removal of the brick from under the boiler. That part of the work belonged to appellant and it was the removal of the brick from under the boiler under the order of appellant's foreman which caused the death of Moren." (57 N. E. R. 773.)

Commercial Review.

NEW YORK, Friday Evening, November 23, 1900.

ELECTRICAL AND OTHER MACHINERY.

The buoyant spirit that has come upon the business world brings out a great number of projects the execution of which would involve the installation of electrical machinery. Inquiry in that line is therefore very brisk. Much work of all sorts is in sight, some of which has come over from before election and other of which is now making its first public appearance. Electrical distribution systems for driving machine tools are among those contemplated, one seller having in view several such in this district. A stronger tone is manifested in a greater readiness on the part of industrial projectors to respond to letters addressed them by the trade. The English agent of one electric company —the C. & C.—advises that the election in this country has had a favorable effect upon business there. In recent orders thence three 80-kilowatt machines are called for.

With all this, however, the increase in actual sales since election has not been what some perhaps expected. At least that is the experience of sellers of direct current apparatus consulted. The parties who have large contracts to place are taking their time about it. The local small motor trade is reported by a concern which does a good deal of it to be quite dull.

The General Electric Company has felt an improvement of trade since the election in its various departments, very plainly, and business is pronounced heavier than ever before. The company got a good thing in its recent contract to furnish six dynamos aggregating 30,000 horse-power for the new generating station of the Niagara Falls Power Company. When these machines are ready their installation will be hurried along so that there may be plenty of current for the Pan-American Exposition in Buffalo. General Electric stock is among those that have been ballooning since the election, having jumped—in round numbers—from 140 to 170.

There is now in immediate prospect an electrical railway equipment of international importance, which it is probably safe to call the biggest yet. This is for the London Metropolitan District Underground Railway, 50 miles in extent, and is estimated to amount to $25,000,000, which probably includes the entire work of equipment. Bids are being put in by the General Electric Company, and it is said also by the Westinghouse Company. The fact that English concerns affiliated with these American ones are about starting in business does not seem to bar them out, whatever explanation there may be for this. French and German companies are also in the race. If the quantity of electrical machinery to be ordered is anything like that to be inferred from the figures mentioned a division of the contracts would seem reasonable in order to avoid the overcrowding of any one plant, and consequent delay in deliveries. The award will be made, it is said, December 1.

In New York City there is now quite a lot of important work going on or in prospect in the way of converting old roads over to electric traction. A test of the third-rail system was made this week on the Manhattan Elevated Railway, some current being obtained for the purpose from the Third Avenue surface road. The result of the trial was regarded as highly satisfactory, and the company may be expected to go ahead and purchase its electrical equipment for rolling stock at an early date. A large quantity of power-house machinery was ordered many months ago. The Brooklyn Elevated's change over from steam to electricity it to be expected sooner or later, and the placing of large contracts with that end in view may come soon. The Metropolitan Street (surface) Railway Company has completed its preparatory work of conversion from the cable to the underground conduit electric system on Broadway, but the latter will not be put in use until the early spring.

The Baltimore & Ohio Railroad Company has ordered of the Electric Storage Battery Company, Philadelphia, an unusually large battery to be used in the haulage of trains through the belt-line tunnel at Baltimore. It will consist of 320 tanks each containing 19 negative and 20 positive plates and weighing about 1,800 pounds. The dimensions of the building to hold them are 145x44½ feet, and the complete battery will be able to develop 1,200 horse-power "for a short period of time."

The Morris Electric Company, which manufactures street cars and a general line of electrical supplies, intends to move its plant from this city to East Orange, N. J. As to the effect of the election on orders, the company has experienced an increase since that event.

H. B. Coho & Co., Incorporated, have been organized to conduct a general electrical supply business at 149 Broadway, New York, where Mr. Coho has been representing and will continue to represent the Eddy Electric Manufacturing Com-

pany. The goods of the Western Electrical Supply Company, St. Louis, also will be handled by the new concern.

The Harrisburg Foundry and Machine Company's local office has felt a material improvement in demand and has booked contracts for a good valuation of engines since election. As these are chiefly for electric work they reflect practically the same business conditions as do dynamos and motors.

We learn from the Nicholson File Company, Providence, R. I., in reply to an inquiry, that the election has been followed by an increased volume of orders and an improved tone to prices. This year, however, is so far advanced that they look chiefly to next year for results. "The outlook for 1901," they say, "is most encouraging, and promises to make the opening record of the new century full of pleasing statistics for capital and full of well-paid labor for the workman."

At one of the general machine tool stores on Liberty street, to-day, business was pronounced continually improving, and even a stiffening in prices was hinted. "There is going to be another shortage of tools next year," an authority was quoted as saying. A Pittsburgh man familiar with business for twenty-five years past had stated that the amount of trade in sight in that vicinity for tool manufacturers was extremely large.

The William R. Trigg Company, shipbuilder, Richmond, Va., is said to have placed contracts for some $100,000 worth of machine tools at a house on Liberty street.

CHICAGO MACHINERY MARKET.

Perhaps the expectations of machine-tool sellers in Chicago were too high, but there is present a certain amount of disappointment at the restricted current trade. Judging from the pre-election talk, which was stimulated by numerous inquiries, there was to be a heavy trade in machine tools, if the election passed off satisfactorily. In other lines of manufacture quite an impetus has appeared to business during the past two weeks, but in the distribution of these commercial favors, machine tools have fared indifferently well.

November, so far, has been a good, ordinary month. That is about the best that can be said of it. The inquiries that were hung up are still on the hooks. The most of them show no signs of immediate action. From a few hints gathered here and there, the inference is drawn that large buying will be delayed until after the turn of the year. It is pointed out that November is usually a quiet month anyway.

The trading of the past three weeks has been mostly for small lots of tools. There is an occasional order for a new plant, usually one of modest dimensions, beginning the manufacture of some specialty on a limited scale, but additions to existing shop equipments for quick needs cover most of the current trade. A few orders reaching several thousand dollars each have been booked, but none are reported of the magnitude of $5,000 or $10,000, a size which was not uncommon several months ago.

The outlook for the machine-tool trade is more inviting than the reality. In addition to the numerous inquiries, that are in a state of suspended animation, many others have appeared during the past two or three weeks, though the prospective buyers do not give any encouragement that purchases will be completed within the next month. The usual formula is that the inquirer will soon be ready to buy and that in the meantime he wishes to learn all he can about prices, terms, etc. The receivers of these missives are accordingly impressed with the view that early next year business will assume a magnitude that is wholly satisfactory.

It is noted also that business is steadily improving. Trade is better than a week ago, considerably better than two weeks ago. The Crane Company bought quite a little machinery last week for the installation of the old Crane elevator plant, which it is about to occupy, and a few similar transactions are giving more life to the tool market.

Machinery, Machines, and Parts of—	September— 1899 Number.	1899 Dollars.	1900 Number.	1900 Dollars.	Nine months ending August— 1898 Number.	1898 Dollars.	1899 Number.	1899 Dollars.	1900 Number.	1900 Dollars.
Cash Registers	....	84,198	989	78,456	....	*	....	*210,233	....	592,957
Electrical	....	262,689	...	396,986	....	1,652,656	....	2,090,737	....	3,987,405
Laundry Machines	....	27,579	....	30,697	....	*	....	*88,265	....	376,465
Metal-working	....	500,043	....	374,147	....	4,091,232	....	4,995,708	....	5,086,372
Printing Presses, and parts of	....	52,843	....	98,766	....	596,257	....	650,737	....	984,362
Pumps and Pumping Machinery	....	239,512	....	174,973	....	1,615,281	....	2,290,711	....	2,151,500
Sewing Machines, and parts of	....	315,707	....	360,542	....	2,438,579	....	2,891,894	....	3,456,434
Shoe Machinery	....	71,104	....	50,050	....	718,290	....	675,561	....	830,115
Steam Engines, and parts of—										
Fire	....	.....	6	15,198	7	6,588	3	13,713	10	22,578
Locomotive	40	355,660	17	135,290	470	4,337,693	403	3,992,452	346	3,616,697
Stationary	95	49,363	111	88,403	394	278,654	644	353,470	1011	613,999
Boilers and parts of Engines	....	110,025	....	233,718	....	902,291	....	1,017,161	....	1,457,110
Typewriting Machines, & parts of	....	225,520	....	173,960	....	1,535,591	....	2,115,558	....	1,994,867
All other Machinery, and parts of	....	1,328,434	....	1,911,942	....	11,397,039	....	14,125,344	....	17,606,831

* Not separately stated prior to July, 1899.

UNITED STATES OFFICIAL STATISTICS OF MACHINERY EXPORTS, INCLUDING SEPTEMBER, 1900.

CINCINNATI REPORT.

There is a very perceptible, and by some considered an unwarranted, dullness in the machine-tool atmosphere hereabouts. The larger concerns admit that aside from some direct orders—for instance, for lathes to be installed in cotton factories—there is very little doing. The manufacturers of electric-power machinery, however, report business increasing with each week. Both the Bullock Electric & Manufacturing Company and the Triumph Electric Company, manufacturers of special types of motors and generators, aver that business is entirely satisfactory.

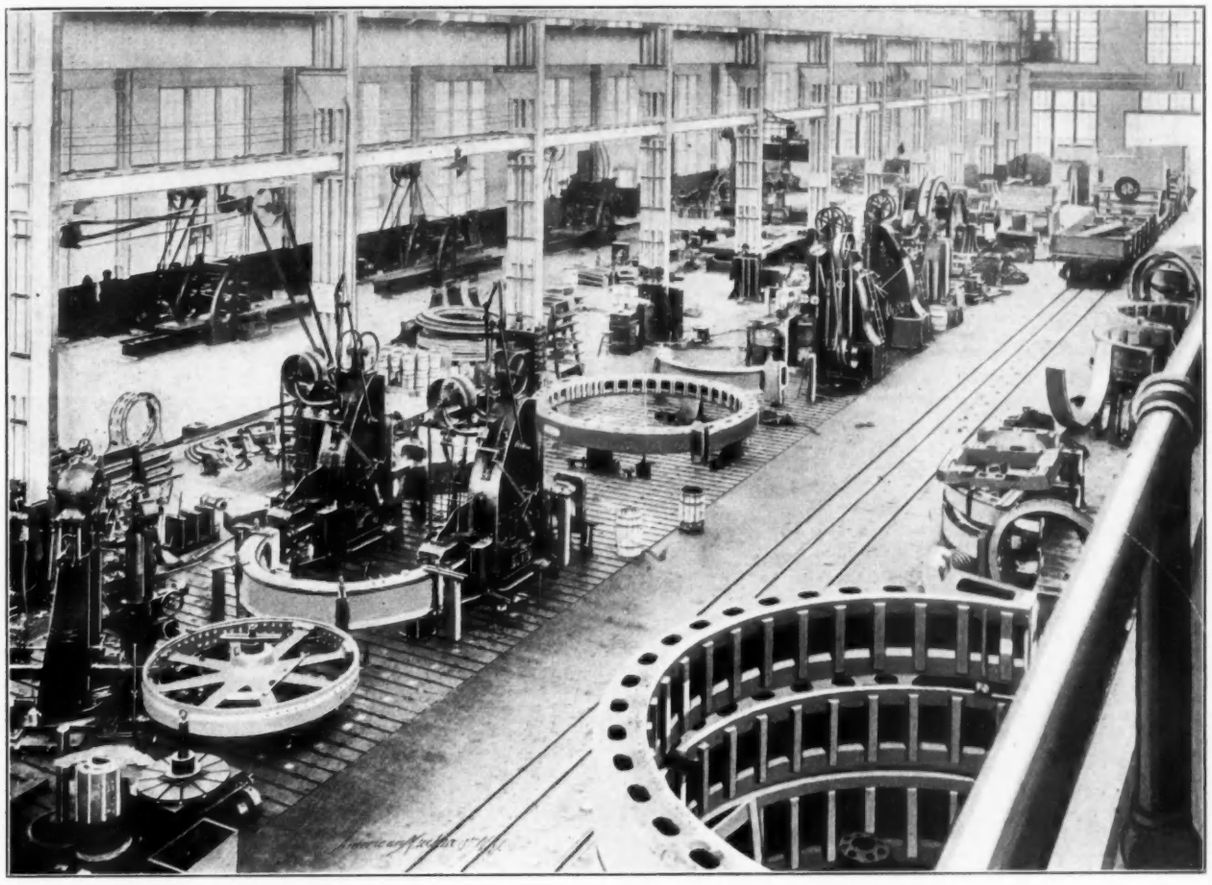
Mr. Boye, of Schumacher & Boye, reports inquiry good and increasing on lathes. He believes the situation will see a material improvement after the first of the year.

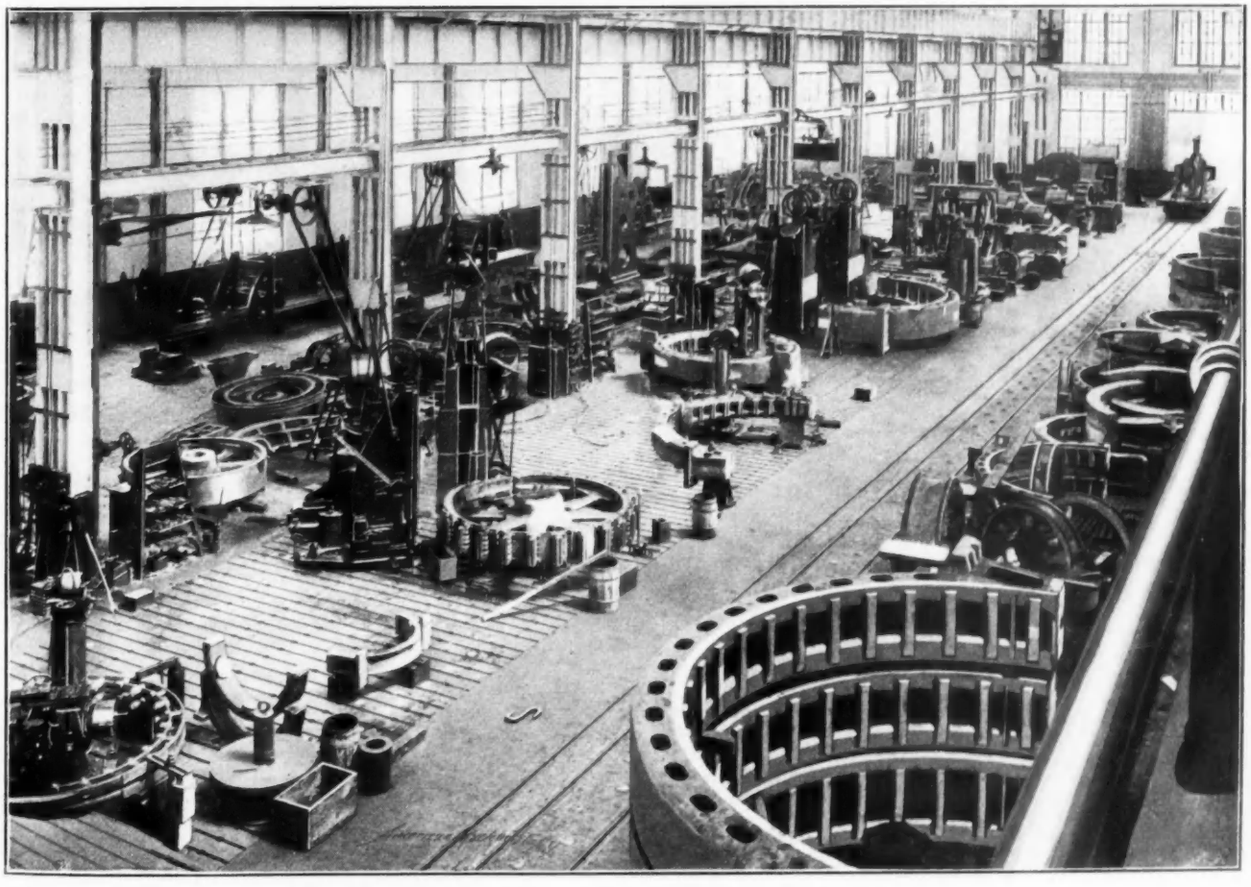
Greaves, Klusman & Co., are of the opinion that the prevailing dullness is to be appreciated by the average manufacturer of importance, as the majority of them have been catching up on orders of the summer. This company has a couple of good-sized shipments of lathes, 16 inches by 10 feet, for a syndicate which operates large cotton-mill plants in Chicago and the State of Texas. These are presumably for use in the repair shops, and this feature of the present situation seems to hold good with a number of the larger manufacturers.

The Cincinnati Machine Tool Company reports a good line of domestic orders with practically no export, and that no material improvement is expected before the first of the year. This firm is getting out an additional machine to be ready in two or three weeks, an upright drill with a new tapping device.

The John H. McGowan Company, dealing in pumps and pumping machinery, is busy supplying municipal plants. Among cities recently supplied are Leipsic and Waynesville, Ohio, for water works, consisting of compound pumps. This company has just shipped a good-sized order of machinery to Australia.

The local papers are endeavoring to make a bit of sensation out of the existing situation between the machinists and the Metal Trades Union. The employees are endeavoring to get a 9½-hour day with 10 hours' pay. Last Monday, the local machine-tool industries reduced their schedule to 9½ hours and maintained that employees shall receive 9½ hours' pay. No trouble is anticipated as the market is overstocked with plenty of skilled labor. There is an undercurrent of opinion that a strong agitation is on in Europe among the dealers to secure a reduction in prices of all American-made machinery. Manufacturers the country over are preparing for this, however, and it is not likely the movement will have any weight. There is a demand for special machinery among the makers of upright drills and lathes particularly. Aside from this there is little going on in the local machinery making world.





FIGS 1 AND 2. GENERAL VIEWS OF FLOOR PLATE, WITH WORK IN PROGRESS.

The Floor-Plate Portable Tool System of Handling Heavy Work at the Works of the General Electric Company.

We have before now illustrated some of the individual portable tools used at the Schenectady works of the General Electric Company in connection with a large floor plate, but the utility of the system has proved so great, and has led to so great an extension of it, that further notice of it is justified, and we present herewith several illustrations from photographs and blueprints, for which we are indebted to the courtesy of the company.

Figs. 1 and 2 are general views of the plate taken from the gallery on the opposite side of the building, although the entire length of the plate is not shown. When this building was erected last year, previous experience with this system led to the putting down of a plate 125 feet long, but this was soon found to be insufficient, and it has already been extended to a length of 175 feet. The width of most of it is 20 feet 6 inches, though portions of it are 25 feet wide. The general views give an indication of the amount and variety of work done upon it, the plate being in its normal condition in this respect.

In Fig. 1 the piece at the left, nearest the observer, is mounted upon a turn-table post, on which it may be revolved from hole to hole, while the drilling machines bore required holes in it. Next to this are two halves of a magnet ring, one of which is having its joints faced by two portable slotters. Beyond this is a complete ring set up and waiting its turn for the machines, and beyond this is another half ring having its feet planed off.

In Fig. 2 an armature spider is seen mounted on a turn-table post, with slots being planed upon its periphery, and beyond it is a complete ring frame with slots being milled in its inner surface—the machine here shown being arranged with feeds for both horizontal drilling and vertical milling.

Fig. 3 gives a nearer view of two of the slotting machines and a drilling machine, all set up about the same piece of work. Fig. 4 shows a special Morton draw stroke shaper planing off the feet of a comparatively small ring frame, and Fig. 5 shows the same machine planing off the pads for the attachment of the rig which carries the commutator brushes.

The tools employed on the plate were all designed especially for it. They are all electrically driven by individual motors built into their structure, and all are fitted with bales, or eye-bolts, to which the overhead traveling crane may be attached for shifting the tools. Suitable and numerous sockets are provided for connecting the electric cables to carry the current to the motors. The plate is equipped with twelve of these portable tools of various classes and at its extreme end (not shown) is an additional stationary horizontal drilling machine.

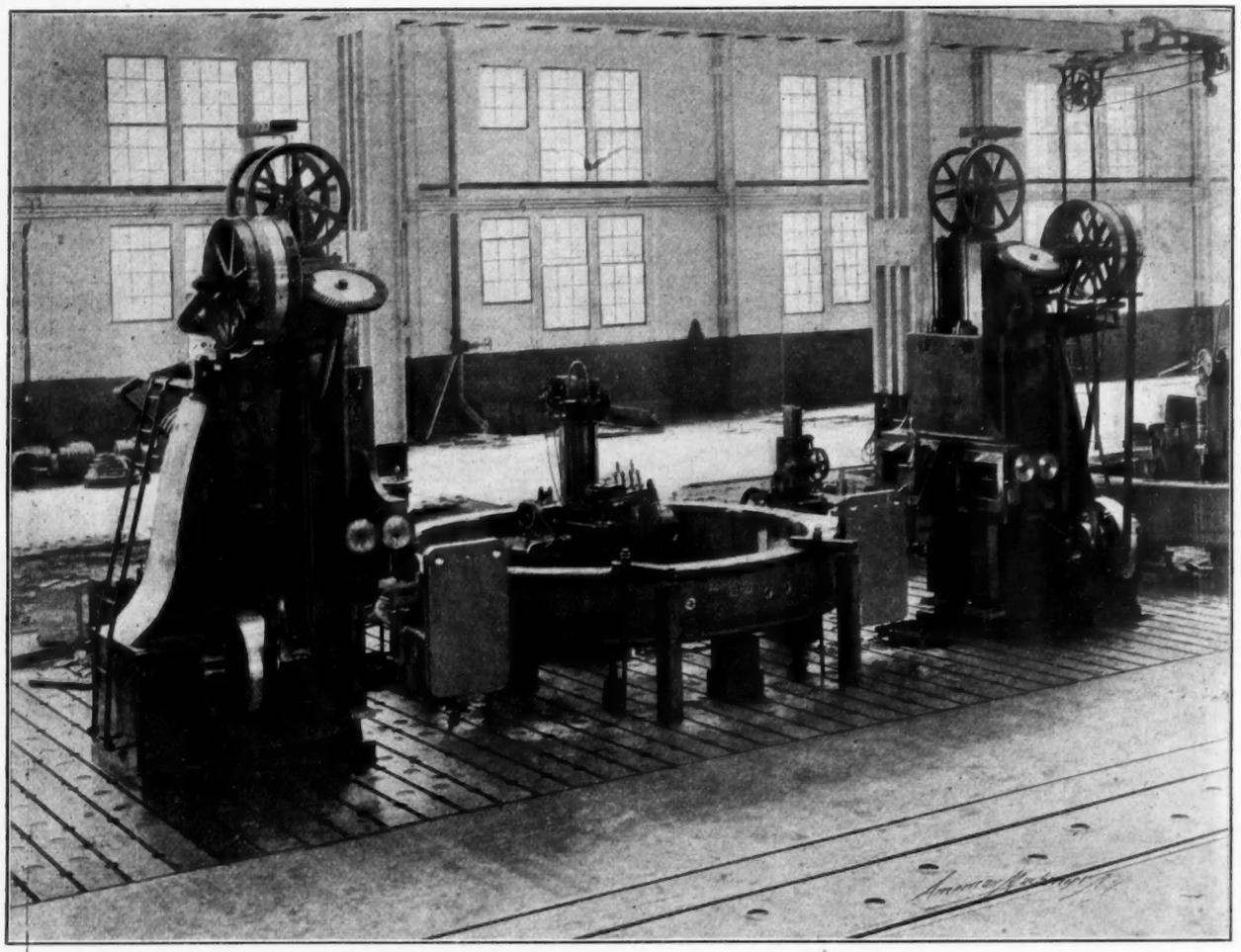


FIG. 3. PORTABLE SLOTTING MACHINES AND BORING MACHINE.

At bottom, of course, the main idea of the outfit is the provision of suitable tools to do a certain class of work which was new when the system was inaugurated. Electricity may be said to have supplied both the problem and its solution, and it is hard to see how the work could be otherwise done with the same convenience or with anything like the same expenditure for plant. In addition to this, however, other features of the system impress themselves on the observer. Chief of these, perhaps, is the fact that the tools are practically always at work. A tool does not stand still while work for it is being set up, as must be the case with stationary

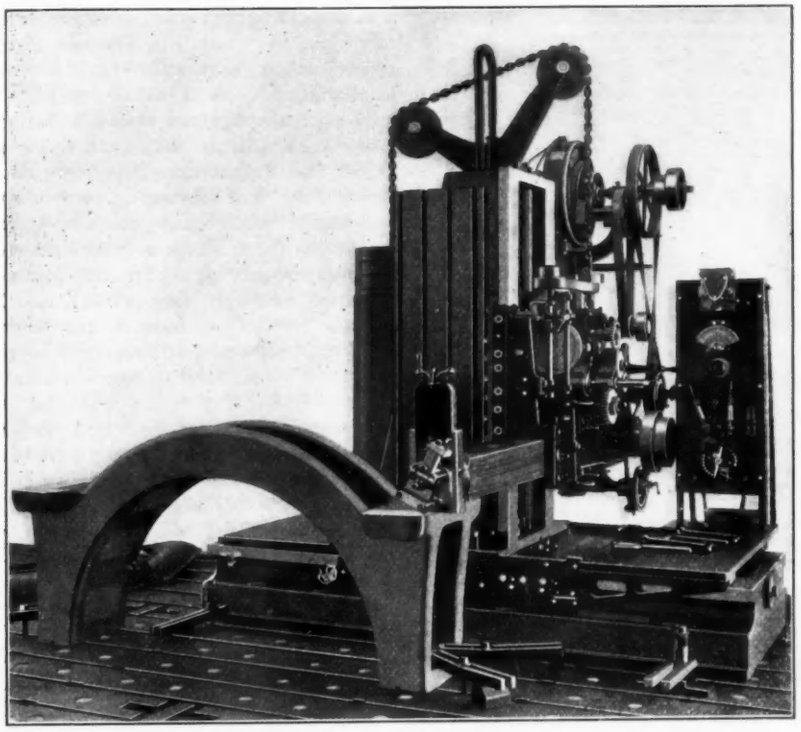


FIG. 4. PORTABLE DRAW-STROKE SHAPING MACHINE.

tools. One set of men will be seen setting up a piece of work on one part of the plate, while the tool to be used on it is at work on another piece of work. When one piece is finished, the only delay in commencing work on the other is that due to bringing the tool to it; and with the crane facilities provided, this is very brief. Another feature, which is illustrated several times in the pictures, is the simultaneous use of several tools on the same piece of work.

Most of the sections of the plate are 8 feet 4 inches wide by 20 feet 6 inches long, the depth to the bottom of the ribs on the lower side being 10 inches. One of these sections is shown in Fig. 6, from which the arrangement of the T-slots, ribs and holes for cement will be clear. The matching edges of the sections have suitable grooves for the insertion of an alining spline, and pockets for bolts to secure the sections together.

The foundation of the plate is shown in Fig. 7, which needs no detailed explanation. The plates were leveled by beginning with an end section, carefully leveling it on wedges—an engineer's leveling instrument being used for the purpose—and then pouring thin cement through the numerous holes. The second section was then proceeded with in the same way, and the others in their turn.

The use of floor plates and portable tools is not unknown elsewhere, but we believe this to be by far the largest installation of the kind in existence. It is certainly of a high degree of interest to anyone having to deal with constructive problems related to large work.

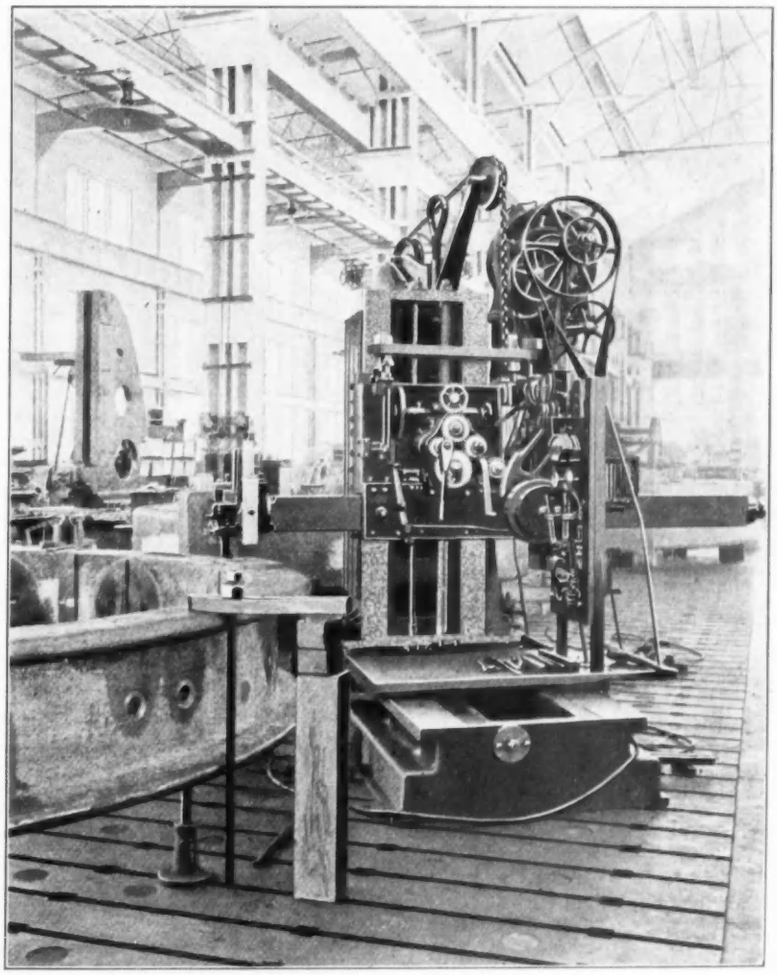


FIG. 5. ANOTHER VIEW OF THE DRAW-STROKE SHAPER.

Echoes From the Oil Country—X.

DESIGNING AND BUILDING OUR ENGINE.

I am beginning to have quite a large stock of respect for the man who designs by guess somewhat—if he's a good guesser. When I figured the size of my connecting rod by formula, and then looked at my old engines, I went back and did some more figuring. I remembered the one we straightened the other day; I couldn't see why it bent, only just that it wasn't strong enough to stand all the strains it got; and yet I figured it had a factor of safety of at least ten. My figures on an assumed cylinder pressure showed about 15; yet it evidently wasn't strong enough to stand all the strain it got; and if my engine goes to acting that way, I will just guess it should have a stronger rod, and guess how much stronger to make it by the length of time it lasted before meeting the combination that was too much for it. If any other part gives away without showing cause, outside of work, I will treat it the same way, if there is any room left to put more material.

I am glad I have lots of old engines to look at. I think they are almost as good as a library for my purpose. If they were larger I would just take some of the

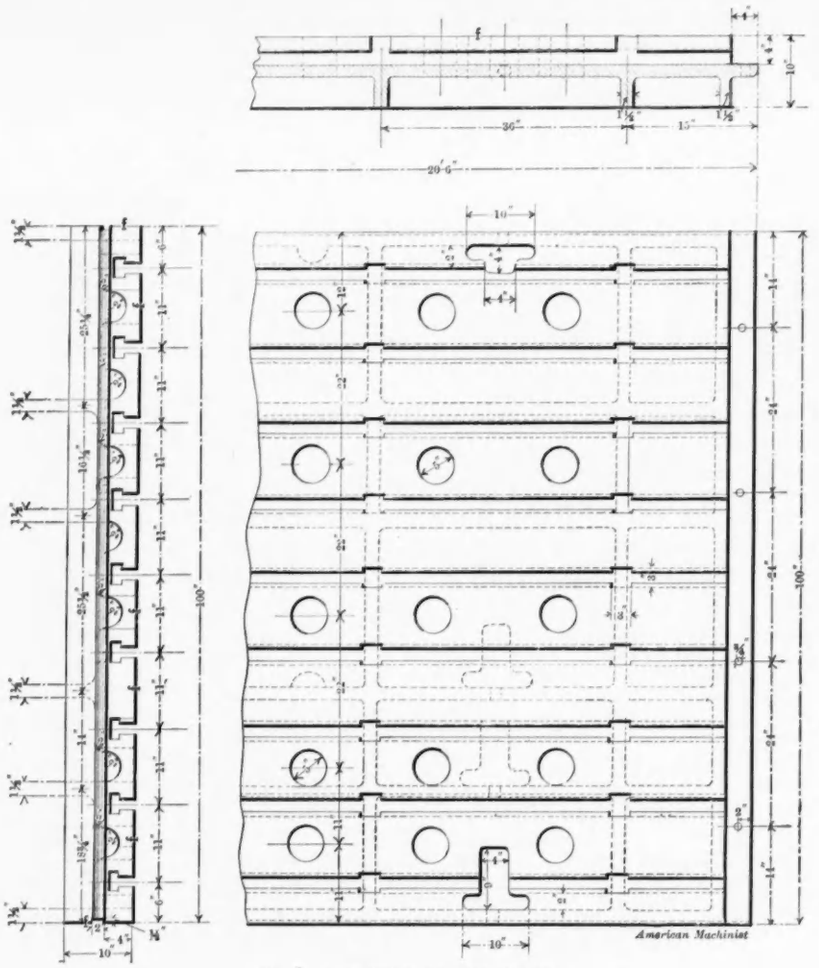


FIG. 6. A SECTION OF THE PLATE.

parts and use them and save making drawings and patterns and castings, and lots of time in the shop.

I gave a sketch of the bed to the patternmaker, and he came back and said he either wanted it full size or else marks to show where I got my curves from, and what shrink rule to use, and how much finish to allow, and whether I was going to make a special flask, and how much I wanted in the core and——. I choked him off long enough to get some cigars, and, after getting his lighted, I took him into the foundry and explained to him and the boss molder that I was exceedingly busy, but that I knew I could rely on their judgment to help me; that there were several details that I had not time to attend to, but I knew they would be safe in their hands, etc., etc., and, leaving some more cigars with them, I made my escape. I hope their judgment will be good, as my reputation depends on it. I am the designer, you know.

When that bed was finally made, and it and the drawing got into the machine shop, the machinist came with it and wanted to know what all the sizes were for. Said he didn't find any sizes that agreed with anything on the casting. Neither did I. I finally told him to clean it up to what it would make, and when he got it done I measured it up carefully. This will explain to those who ever have to repair this engine, why some of my sizes are so odd. I learned one thing, though; that is, not to make too much at once. I can alter my crosshead, shorten my connecting rod, lengthen my piston rod and make my gland larger, and it will be all right.

The cylinder is better than I hoped for. The ports are a little wider and closer together than I planned to have them, but I can fix that. The molder is a pretty clever fellow, after all. He got out a real good flywheel without a pattern. Used a sweep for the rim and 1¾-inch round iron for the arms. Cast the rim one day and the hub the next. I thought he should cast the hub first, so as to compress on the spokes, but he said the wheel would be badly dished if he did.

It worried me trying to scheme to bore that wheel, but I might have saved my worry, as Sam came and asked me if he might bore it. I asked him how long it would take, and he said he thought about half a day, making tools and all. As the crank is here for the engine, I told him to go ahead. Two old glands bored to fit a 3-inch bar, with the outside fitted to holes in a couple of pieces of oak planks about 3 feet long; a piece of ¾-inch iron with a thread about 10 inches long; a pulley that fitted the bar, with the help of some shims; a piece of iron long enough to reach out to the rim and champed to the bar to act as a tram for setting; two set collars—only used in setting the rig true—some blocks, wedges and bolts, a piece of rope, a short piece of scantling, some nails and a couple of boring cutters for the bar completed Sam's rig.

I watched him with interest, determined to stop him if I saw his plan would not give a true job; but he appeared to be at ease and confident. He soon had the planks with the glands in them bolted to the wheel, one on each side, with a block

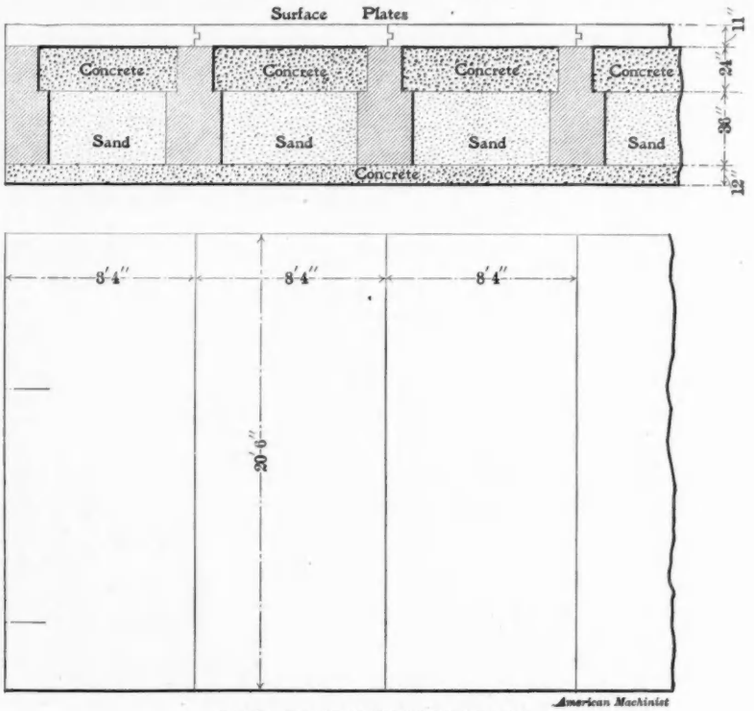


FIG 7. FOUNDATION OF THE PLATE.

under each end resting on the arms, so as to hold the glands a few inches clear of the hub. The bar was slid into place, with the two collars slid on so that there was one on each side of one of the glands, thus stopping any end play of the bar. With the tram rod clamped on the bar outside of the gland, the operation of setting the bar true consisted in driving the planks as the tram indicated. As the driving got to be more easy and careful, I came around and inspected it, and found everything very close. I could not indicate where to better it on a rough wheel. I forgot to state that the wheel had been set up near an unused pulley on the line shaft and blocked so as to be secure.

Sam now proceeded to show me one way to bore a wheel. He took out the bar, took off the collars and put it back, put in a cutter, set his scantling on end, after boring a 7/8-inch hole in it the right distance from the end, to bring the hole at the center of the wheel, on the side of the wheel where the cutter was. He stuck his 3/4-inch iron with the long thread on through the hole in the scantling, fastened the nut on it to the scantling with a few nails, nailed the bottom of the scantling to the floor and tied the top to the wheel with the rope; made a friction clamp of two pieces of inch board and two bolts, put it on against the outside of the gland, put his pulley on the other end of the bar, hunted up some old pieces of belt, and soon had things going merrily.

The end of his screw had been ground to a point, and with a dog on the other end it was run up into the center in the end of the bar, and Sam soon had a cut going, and settled down contentedly on a box, with his oil can and hammer handy, whistling a tune and acting as a self-regulating feed for his boring mill. Several cuts were necessary to finish the hole, and before the last one was run through, the tram was put on and the setting gone over very carefully. If everything on our engine is as good as that wheel, she'll be all right. W. OSBORNE.

The Traveling Liquid Air Boom.

Liquid air seems to be very quiet in our immediate neighborhood at the present time, but a friend kindly sends us some interesting printed matter concerning it which is being distributed from Indianapolis. There are no new promises and no larger promises made, probably, than have been made before, and absolutely no information is given as to any remunerative or profitable use to which liquid air has ever been actually put. Indianapolis, according to the prospectus, is a grand place for a branch liquid-air installation. "There is not at the present time, west of New York City, a company engaged in making liquid air for practical use." There is none east of New York or in New York, as far as we are informed. The liquid air companies sell little except stock.

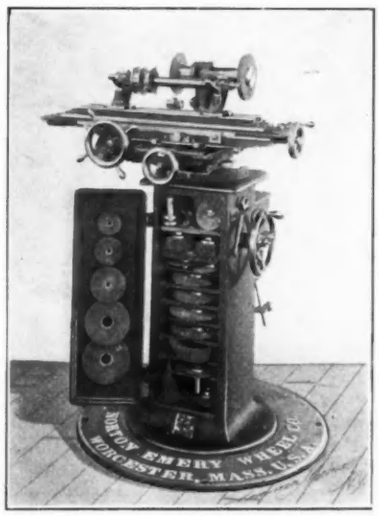


FIG. 118. THE NORTON GRINDER, WITH AUTOMATIC FEED, AS SHOWN AT PARIS.

The Paris Exposition—XV.

A GRINDING MACHINE.

I believe it is the experience of everybody who builds a cutter grinder, that, no matter how complete it may be, nor how many different kinds of work it is designed to do within the field for which it is intended, a goodly proportion of users want to do more with it; that is to say, they want it to go outside of its field and do work of a class for which it was not originally intended—grind arbors and all kinds of cylindrical and conical work. In effect they say, "Here we have an arbor mounted in boxes and adapted to run all kinds of emery wheels. In front of it is a platen on which are mounted centers. What can be simpler than to put on a pulley to rotate the work and an automatic feed and reverse motion to the table? and when this is done we shall have a complete grinding machine." Of course,

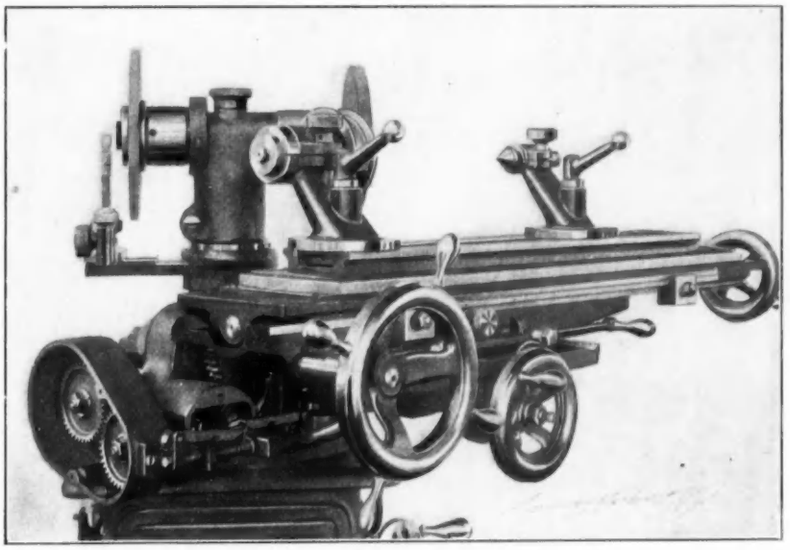


FIG. 119. FEED-REVERSING MECHANISM OF NORTON GRINDER.

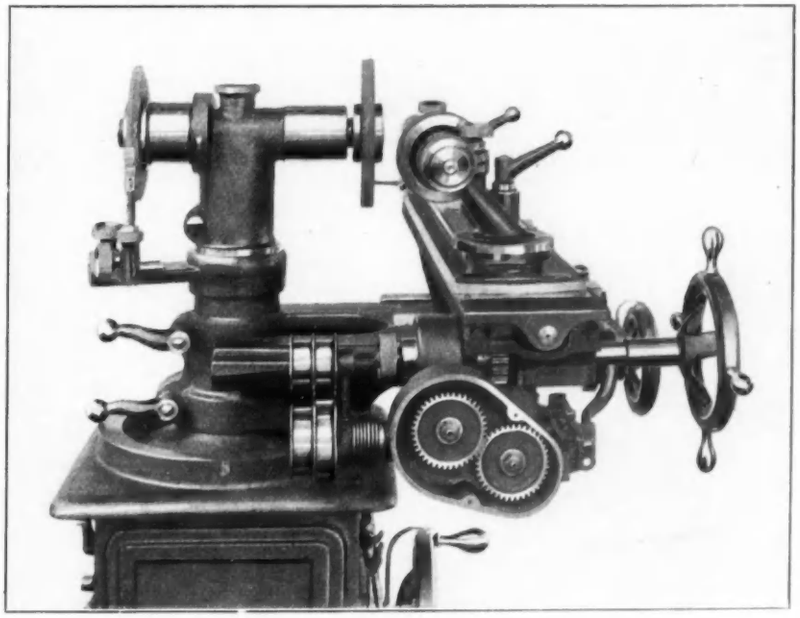


FIG. 120. FEED MECHANISM OF NORTON GRINDER.

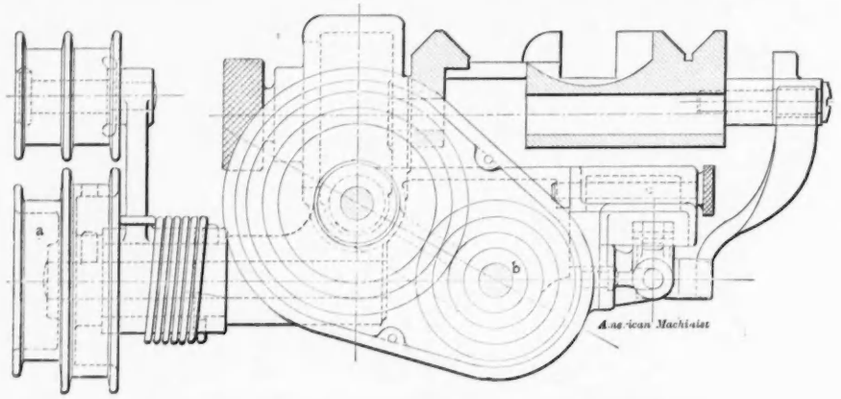


FIG. 121. END VIEW OF FEED MECHANISM OF NORTON GRINDER.

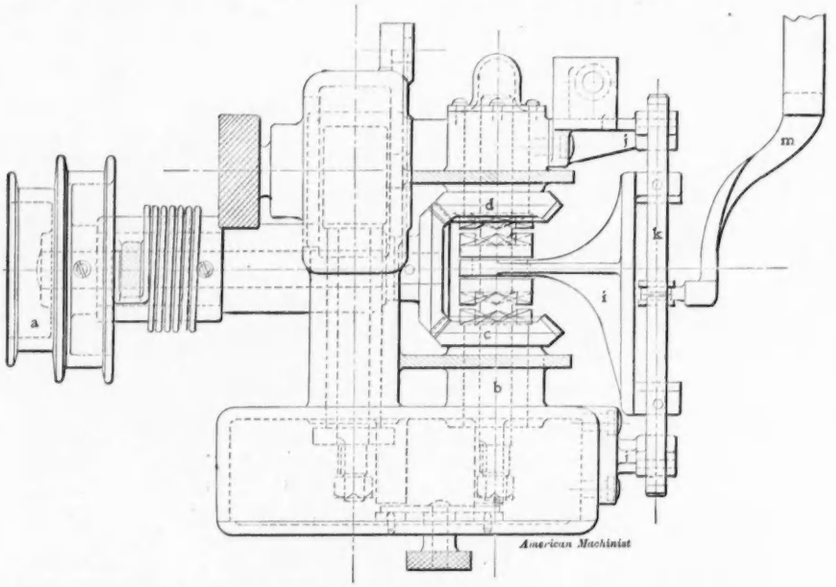


FIG. 122. PLAN VIEW OF FEED MECHANISM OF NORTON GRINDER.

those who are well up in the art of grinding know that there is more to it than that, and none know it better than those who make the cutter grinders; but the fact remains that there is a demand for a cutter grinder that will do the jobs of other kinds of grinding that occasionally come along in some shops and that must be done somehow—shops in which a man who had only full-fledged universal or plain grinders to sell would have a very hard time in trying to do business.

At Paris there is a very interesting example of the evolution of a cutter grinder into a grinding machine. It is exhibited by the Norton Emery Wheel Company, of Worcester, and in its original form, as a cutter grinder, was quite fully illustrated and described in our issue of October 12, 1893, as a part of the exhibit of machine tools at Chicago, and in an improved form in issue of May 21, 1896. It will be remembered as remarkable for the completeness with which it provides for every contingency that can arise in the problem of grinding all sizes, kinds and conditions of milling cutters, and the automatic feed and reverse which have now been added to it enable it to do other work which, before, was out of its reach. The machine as it now appears is shown complete at Fig. 48, while the mechanism of the feed will be understandable from Figs. 119 to 124, inclusive. The manner in which the desired end has been accomplished is interesting and well worth a little study.

From the drum countershaft a 5/8-inch flat belt is carried to a two-step cone pulley *a* on the attachment, where an automatic tightener keeps the belt taut regardless of the position of the table. This is done by the pulley above *a*, which is at the end of an arm, so that it is pressed against the belt by the helical spring shown.

From the cone pulley the motion is transmitted through a shaft and bevel gear to a pair of bevel gears, the axis of which is at right angles with the driving shaft, and which also serve as boxes for a shaft *b*, Figs. 121-2-4. This shaft *b* carries the reversing clutch, and, by sliding in its boxes, alternately engages the reversing clutch with the clutches of the bevel gears *c* and *d*, Figs. 122-3, which are being driven in opposite directions. A spur gear on one end of the clutch shaft engages with a spur gear on the worm shaft (seen in place in Figs. 119-20), thereby driving the worm gear *e*, which runs free on the pilot-wheel shaft *f*, Fig. 124. This shaft *f* carries the pinion that engages with the platen rack. To put the feed in operation, a friction clutch, which is keyed to the pilot-wheel shaft, is forced into contact with the worm-wheel *e*.

The movement of the table is defined by two dogs which, at the end of the desired travel, move the shipping rod at the front of the table, thereby alternately compressing the springs *g g'* and releasing them at fixed points by the lifting of pawls *h h'*, Fig. 123, which are hinged in the tops of the fixed brackets *j j'*, which also form the bearings that support the shift-rod *k*. The clutch-fork *i*, Figs. 122-3, is attached to the shift-rod *k* at two points, as shown, and carries two lugs which are adapted to engage alternately with the notches in the lower edges of the two pawls *h h'*, one of them being shown thus engaged in Fig. 119. The first action of the dog on the table is to compress the helical spring, and at a certain point the pawl is released by the action of the shifter *m*, upon the beveled end of the pawl and the spring throws the clutch over, reversing the feed and at the same time allowing the other pawl to engage ready to act at the next reversal. The Norton Company states that this feed will reverse at the same place continuously within .001 inch.

The attachment is given a neat appearance by having the spur gears enclosed in a case, the cover of which is quickly removed by turning a knurled knob, while the reversing mechanism is protected by a cover which is held in place by a thumbscrew. The attachment is securely fastened to the bed of the grinder by three screws at the back and one underneath, besides having the pilot-wheel shaft pass through the upper part of the main casting of the attachment.

The clutches are made of steel with oil-tempered teeth, as is also the case with the working parts of the pawls, and the parts of the shipping rod and reversing lever (a steel casting) which come in contact with the pawls are case hardened.

A great variety of different speeds for table travel can be obtained by the use of the change gears which are provided. There being three combinations for the spur gears, there are with the cone pulley six different rates of table travel for each speed of the work.

Aside from this machine the exhibit of the Norton Company was one of the most attractive to be seen in the machinery building, the artistically arranged booth being constructed of emery wheels, emery bricks, etc., and in front being a device for showing the porosity of the Norton wheels by means of a spout which at regular intervals turned a stream of water onto the side of a wheel placed under it, which water passed through the wheel immediately to the basin below.

A LARGE DRAWING PRESS.

One of the most prominent displays in the United States machinery section at the

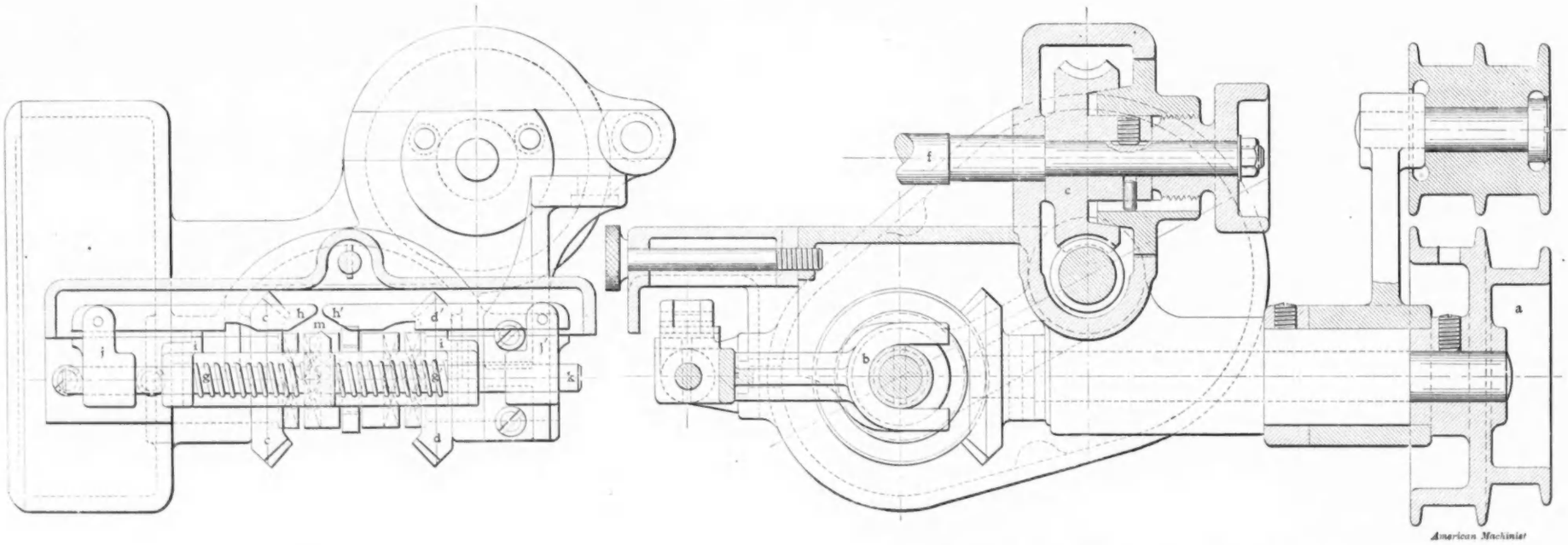


FIG. 124. FEED MECHANISM OF NORTON GRINDER.

FIG. 123.

Champ de Mars was that of the E. W. Bliss Company, of Brooklyn, and from their exhibit I have selected two presses that seem to possess new features and some points of special interest.

The first of these is the press shown at Fig. 125. It is a new type of Bliss, bottom slide, toggle drawing press, which has been designed to meet the requirements of certain manufacturers who prefer a press with a movable bed in place of the stationary one, which is a feature of all the other lines of Bliss drawing presses. One of the distinctive features of this press is in the fact that it has all its principal working parts overhead, where they are readily accessible and more easily under the observation of the operator than could be the case where they are down in a pit; an arrangement which is of course especially advantageous where, as is sometimes necessary, the machines are crowded as closely together as possible.

The bed is counterbalanced in such a way that the counterweight may be varied to compensate for different weights of dies, and the long range of adjustment permits of unusual die space, and therefore, the use of long inside blank holders.

The toggles beneath the bed transfer the strain of blank-holding to the frame of the press, leaving the crank-shaft free to do the drawing without unnecessary pressure upon its bearings. These toggles are operated by a cam on the main gear, which is timed to the best advantage, enabling the operator to remove the drawn shells and place new blanks under the dies with the greatest possible ease and convenience when working to the full capacity of the press. Its weight, as shown, is about 33,500 pounds, and it attracted a great deal of attention at Paris among those interested in press work.

A MULTIPLE DRAWING PRESS.

The other press (shown at Fig. 126) is a Stiles geared press, which has been designed to produce, with great speed and economy, such articles as lamp burner shells, stove trimmings, harness oil can tops, small coffee and tea pot covers, lantern parts, and other similar articles made in large quantities, which require a series of operations after the first cup or shell has been produced in a combination or drawing die. The first-operation shells are placed on the friction dial, whence they are carried automatically by the reciprocating feed from one to another of the several dies, and are then automatically discharged. All the dies operate simultaneously, and as the press may be run at a speed of 40 to 60 strokes per minute (according to the size and shape of the shells), its output of 200 to 300 operations per minute is equivalent to the work of ten to twenty single slide presses fed by hand. As the press may be fed by an inexpensive operator, and as there is no intermediate handling, the amount of labor and shop room saved, as well as the entire absence of danger to the hands of the operator, are items of very great importance. The machine is regularly built with four or five punch carriers; but where an additional number of operations are required, it may be built wider and additional punch carriers provided. As shown, with five punch carriers, the press weighs 4,800 pounds.

Dies for cutting, forming, perforating, lettering and flanging may be operated in this press, and the number of operations

that may be performed is limited only by the number that can be done without annealing. Shells requiring a less number of operations than there are punch carriers in the press may be handled just as readily as though the full number of dies permissible were being operated.

This machine represents the latest achievements in the art of manufacturing the class of articles specified, and seems to reduce the labor cost of their production to an almost inappreciable fraction of their total cost.

THE LARGEST ELECTRIC GENERATOR.

The largest electric generator at Paris (said to be the largest ever built) is

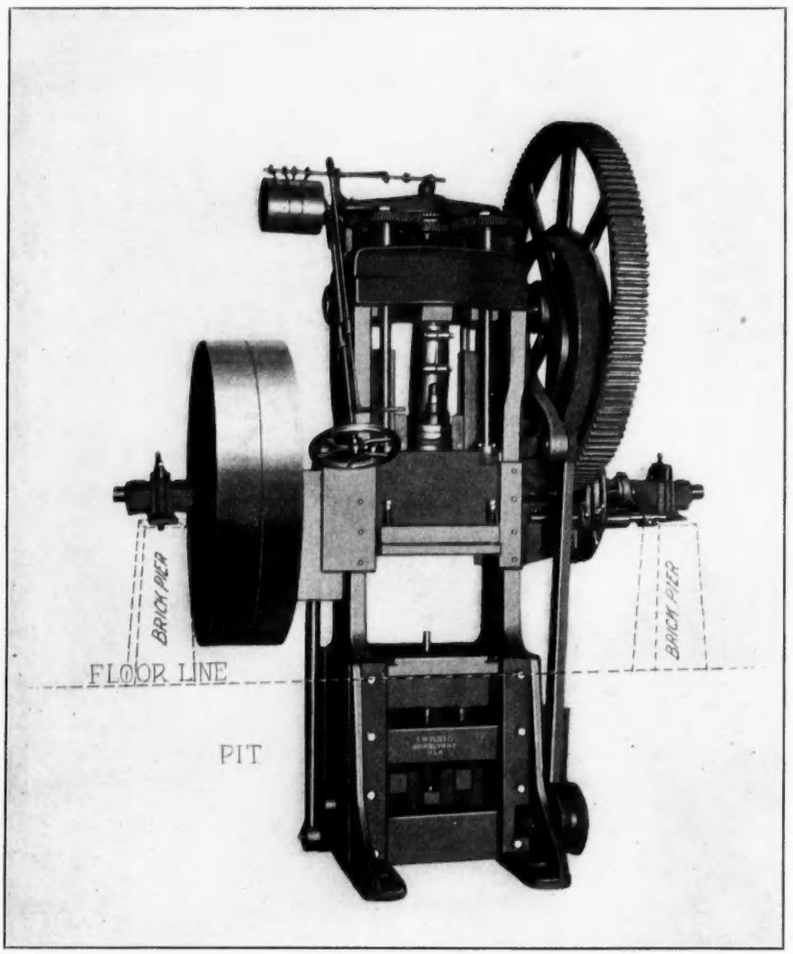


FIG. 125. BOTTOM-SLIDE, TOGGLE DRAWING PRESS SHOWN AT PARIS BY THE E. W. BLISS COMPANY.

shown in the German Annex. It does not run there, but is supported upon a framework made for the purpose, and to afford facilities for inspecting it, as shown at Fig. 127. It was built by the firm whose name and address are cast at the top of the machine, familiarly known on the continent as the "A. E.-G." This is a concern which may be taken as typical of Germany's rapid industrial development within recent years. It is about seventeen years old only, yet its works cover a floor area of about 57 acres; its share capital is $15,000,000, and 14,000 people are employed by it. The dynamo referred to is one of twenty-one similar machines which are to be built for the Berlin Electric Works. "Engineering," of London, has recently published a description of the machine, from which I extract the following:

"This machine (type G. D. M. 83/3,000 of the company), exhibited in the German annex, with its output of 3,000 kilowatts at 83 revolutions per minute, belongs to the largest electrical machines yet built. For a power factor, cos. $\gamma = 0.9$, 4,000 horse-power are required to drive it.

"The three-phase winding is contained in the stationary frame, while the magnet inductor, excited by continuous current, revolves within the frame and produces the magnetic field. The 'star' winding of the frame is calculated for a phase electromotive force of 3,460 volts, corresponding to an electromotive force of $3,460 \times \sqrt{3} = 6,000$ volts between any two leads, while the current per phase is 290 amperes. In spite of the high electromotive force the current is still so considerable that massive copper rods are used for the winding of the machine, each rod being covered with micanite. The iron core of the frame is built up of sheet iron segments with slots (Fig. 128). In each slot a copper rod is bedded and securely held by a wooden wedge.

"The end-connection of the separate copper rods is effected by means of forks, the parts of which are separated by sufficient air space to insure permanent good insulation. In building this machine very great care has been taken to obtain thorough ventilation, especially at the forks, thus allowing a long range for overload. For this purpose the sheet iron of the core is made with special ventilating slots. The resistance of the frame winding is 0.98 ohms for each phase.

"The magnet inductor has 72 poles, so that at 83 revolutions per minute the machine generates current at 100 alternations (50 cycles) per second. At full load the excitation amounts to about 31 kilowatts, or 1 per cent. of the total output of the machine. The inductor at the same time has built into it the flywheel mass to give the necessary minimum angular variation of 1 in 300, and its peripheral speed amounts to 104 feet per second.

"The stationary frame of the dynamo has a diameter of 28 feet 2 inches, that of the inductor is 24 feet 4 inches. The total weight of the dynamo is 160 tons [358,000 pounds], made up of 80 tons [179,000 pounds] for the frame, 70 tons [156,600 pounds] for the inductor, and 10 tons [22,400 pounds] for the foundation plates, etc.

"To transport this enormous machine from the A. E.-G. works at Berlin to Paris it was taken to pieces and carried on eleven special double-bogey trucks. Each part was carefully placed on the trucks in the proper order for erection, so that on arrival at Paris no time was lost, and each part was lifted from its truck into position. As there was no overhead crane in the German annex, and the structure of the building was too light to allow a crane to be put up, the whole of the erection of this great machine had to be done by means of winches and specially constructed erecting wagons. In spite of the extraordinary difficulty of this method, the erection was completed within three weeks.

"The small air space between the frame and the inductor, amounting to only a few millimeters, required to obtain good magnetic results in the dynamo, necessitates the most accurate and careful finish of all the parts. The enormous frames, in four parts, are first put together, and then turned on large horizontal lathes. The inductor also is built up of four parts, which, as may be found necessary, are finished singly or as a whole." F. J. M.

British Official Tests of Shot-Gun Barrels.

Consul Halstead sends from Birmingham, England, the following interesting account of the official tests which are insisted upon for all shotgun barrels sold in England. He says:

"It happened recently that in a shipment

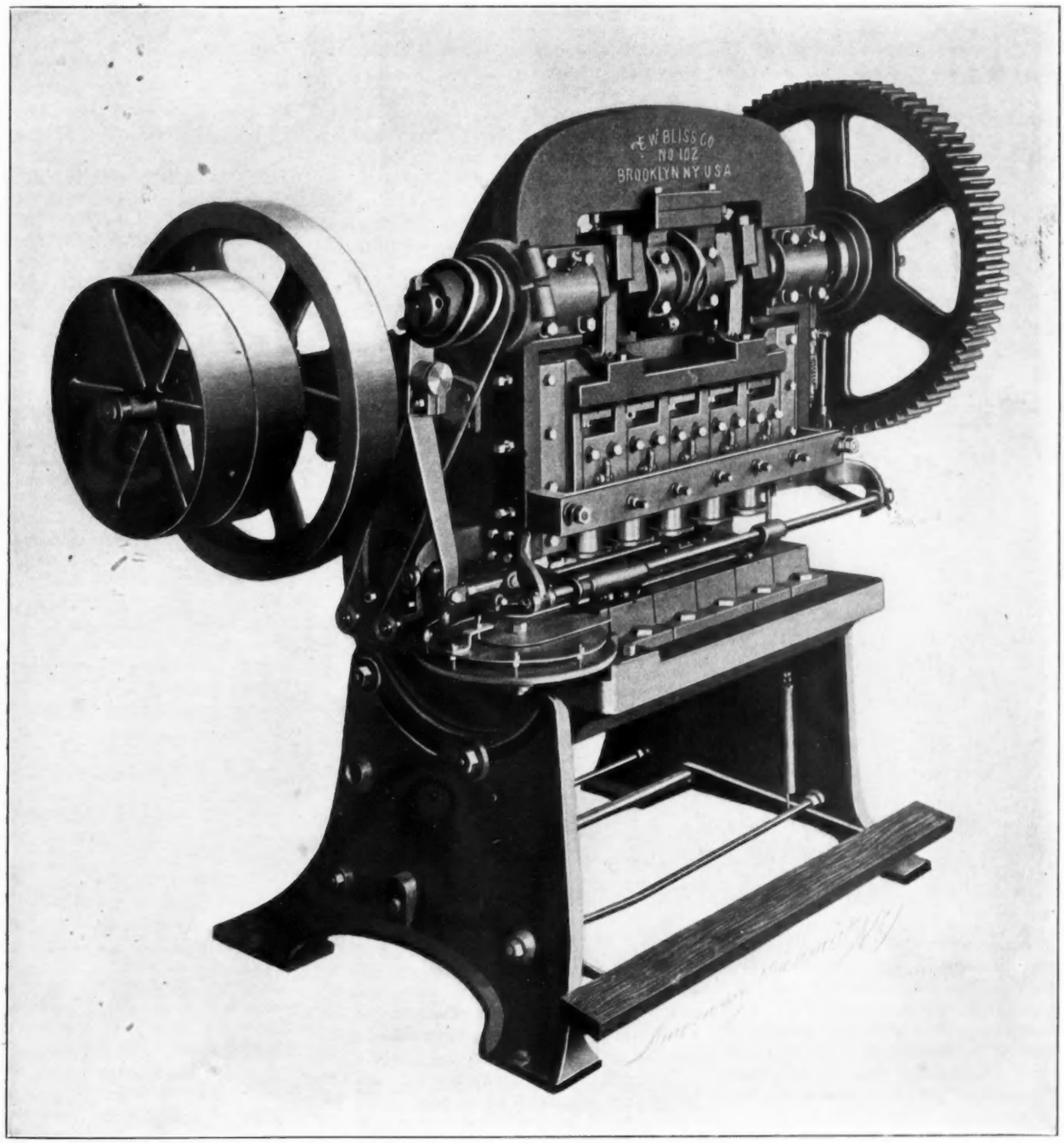


FIG. 126. MULTIPLE AUTOMATIC DRAWING PRESS SHOWN AT PARIS BY THE E. W BLISS COMPANY.

of American double breech-loading shotguns every one offered for Birmingham proof-house test either burst or bulged. The explanation is that there are legal requirements here which the American manufacturers of double-barreled shotguns are not complying with. It should be distinctly understood that the unfortunate results do not reflect on the quality of these American guns, and also that there is no intentionally protective discrimination here against the American gun.

"It is a legal requirement that guns, before they are sold or used in Great Britain, shall have withstood two prescribed tests of strength. As will be explained further along, this affects our double shotguns only. The British maker, before putting shotgun barrels together, sends them to the proof-house, where they are subjected to a very severe explosive test, and if they withstand this, the maker may feel assured his material is all right; each barrel having received the proof-house mark to indicate that it has withstood the preliminary (called "provisional") or severer test. When gun barrels have been finished and the action attached (of course, in the finishing process the size of each barrel has been lessened and its strength reduced correspondingly), a final test is made which is not so severe as the first, and each barrel and the action then receive the final or 'definitive' proof-house mark, which enables the manufacturer to sell the arm, and the purchaser to use it anywhere in Great Britain.

"German and Belgian proof-house marks are accepted in England, so that gun-manufactured in those countries are salable in Great Britain without further test, so long as they bear no name or mark which might lead a purchaser to suppose they were of English make. In the United States there are no corresponding legal test requirements, and the result is that guns shipped to this country in their finished, and therefore weakened, state must

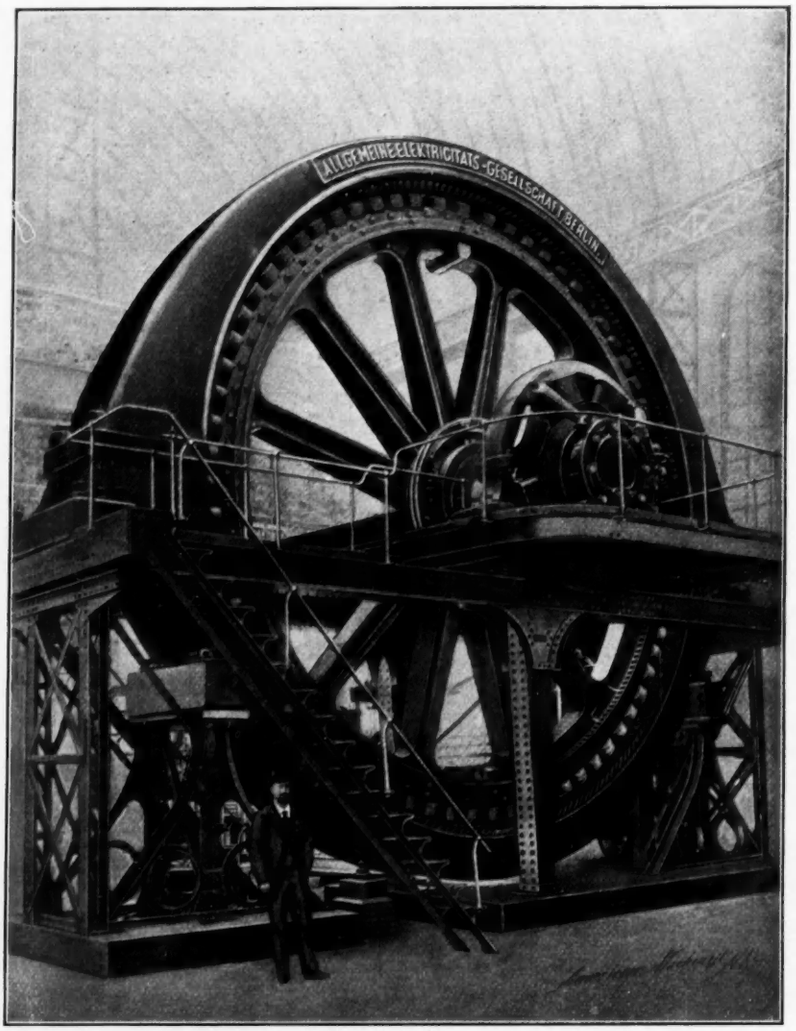


FIG. 127. 3,000-KILOWATT GENERATOR SHOWN AT PARIS BY THE A. E.-G., OF BERLIN.

receive, in accordance with the law, the severe primary test as well as the final test. American rifle, pistol, and many single breech-loading shot barrels, even in the finished state, are still so strong they pass the great ordeal; but it is almost impossible for any finished double-shotgun barrel of ordinary weight, wherever made, to stand the primary test which must be given here.

"If American guns are to be sold here, the unfinished tubes should be sent here for the provisional test and returned to America for finishing; and at any time afterwards, the guns can receive, as do the British guns, the final and easier test and get the proof marks. A great many English gun barrels in unfinished shape are sent to the United States, and American manufacturers buying such barrels should see that they have the British proof-house provisional mark, and this mark would additionally be valuable, if the gun is afterwards exported, in making proof before the United States Treasury officials to obtain the 99 per cent. rebate of the duty paid when imported.

"A difficulty in establishing governmental American gun-proof tests would be the necessity, on account of the great size of the United States, of having many proof-houses, for even with north, south, east and west stations, gun manufacturers would still be at heavy expense in shipping guns for test our long distances.

"The charges in Birmingham for making the tests are 2½d. (5 cents) for provisional proof, and from 4½d. to 8d. (9 to 16 cents) for definitive proof, per barrel. It is less costly to have the proof made at the Birmingham proof-house than at the London house, because the Birmingham proof-house acts come under comparatively recent legislation; profit is not an object, and as an encouragement to the great gun industries of the district a minimum fee is always charged; while in London the proof-house is under the control of the great gunmakers' guild, which has, like many other guilds, ancient rights, with which Parliament has not seen fit to interfere, and the maximum fee is charged. All the guilds, or great London companies, naturally enough stand together as a great power when any legislation is proposed affecting the special privilege of any one of the number."

Municipal Control of a Subway.

In explaining the Paris subway system to the Street Railway Commission Prof. Edmund J. James, of the University of Chicago, said that municipal ownership had received an impetus in Europe from the growth of the belief that a corporation always gets the advantage in any franchise.

The municipality of Paris desired to construct and operate its underground system, but was blocked by the State Government. Then a middle course was adopted, the city building the tunnel and substructure, while a private concern was authorized to equip and operate the road. Provisions to allow the city to secure the road at any time within seven years and the reversion of the system to the city after thirty-five years were pointed out by Prof. James as evidences of the growth of the municipal-ownership idea.

Stringent regulations govern the private concern. Compensation is secured through low fares, while the amounts paid into the city treasury are eventually to liquidate the loan of $35,000,000 authorized by the State for the construction of the system. The city, through the franchise to the company, regulates the treatment of employees and the running of trains for the public convenience.

Of the 40 miles first contemplated, but 8.7 miles have been completed, 6.8 miles of which are a trunk line running from one side of the city to the other. The original estimate was $30,000,000, to which was added $3,000,000 for reconstructing sewer systems and $3,000,000 for an increase in the gage of the road, determined upon later. In addition to this, it was estimated the private concern would have to pay $10,000,000, making the total cost $46,000,000. The cost of proposed added lines

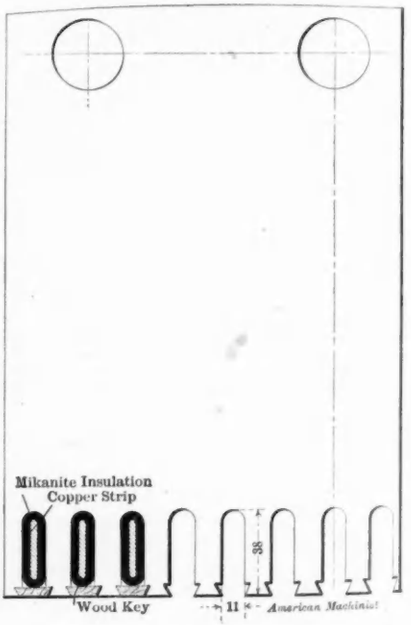


FIG. 128. DETAIL OF 3,000-KILOWATT GENERATOR.

will increase the mileage to 50, and the cost to the city to $46,400,000.

Plans for an underground road have been contemplated for fifty years, according to Prof. James, but the World's Fair of 1900 brought the opportunity and the consent of the General Government to city construction. Prof. James said:

"The company is required to keep the track, plant and rolling stock up to the highest point of technical efficiency throughout the entire period of the lease, and the city is authorized, if in its judgment the company is not properly guaranteeing the public interest in this matter, to take possession of the road during the last five years of the lease and convert the income of the same to putting the road in first-class condition for the time when it becomes the property of the city.

"At least 135 trains in each direction per day are required, and it is estimated 110,000,000 passengers per year must be carried to enable the city to meet obligations, all over this number being net profit.

"First and second-class fares are provided. Price of a single ticket, second class, from any one station to another, is 3 cents; first class, 5 cents. School children conducted by a teacher are carried at the uniform rate of 1 cent. The city loan is secured by a levy of 1 cent upon every second-class ticket except the school children's ticket, and 2 cents upon every first-class ticket. It will be seen that this is a very simple arrangement for dividing the risks between the city and the company. French Governments, general and city, like American Governments, have found it extremely difficult to carry out any scheme of dividing profits with private enterprises. The managers of such companies know so well how to conceal profits by all sorts of devices that the State or city rarely derives any advantage from such arrangements.

"Clauses in the agreement for the benefit of employees and laborers provide minimum wage of 150 francs ($30) per month, a ten-hour day, with one rest day a week, and an annual vacation of ten days with full pay. Full salary must be allowed during periods of military instruction and days of sickness certified to by a physician, and in case of accident received while on duty. Accident insurance by the company is not deducted from wages. Every employee is credited with a deposit book in the national pension fund, payments to be made by the company, which is entitled to take 2 per cent. from the wages, but must deposit 6 per cent. to establish a gratuitous medical and drug service and to insure workmen and employees against accident. These stipulations in favor of workmen and employees probably go further than any similar stipulations made by other cities.

"Under this scheme the city of Paris secures a much needed and most important increase in its facilities for local transportation. It secures low fares and good accommodations for the public. It will undoubtedly obtain a handsome revenue. The whole history of this enterprise is calculated to strengthen one's faith in the representative government. The best features in the system are those proposed and worked out by the City Councils of Paris." —Chicago "Record."

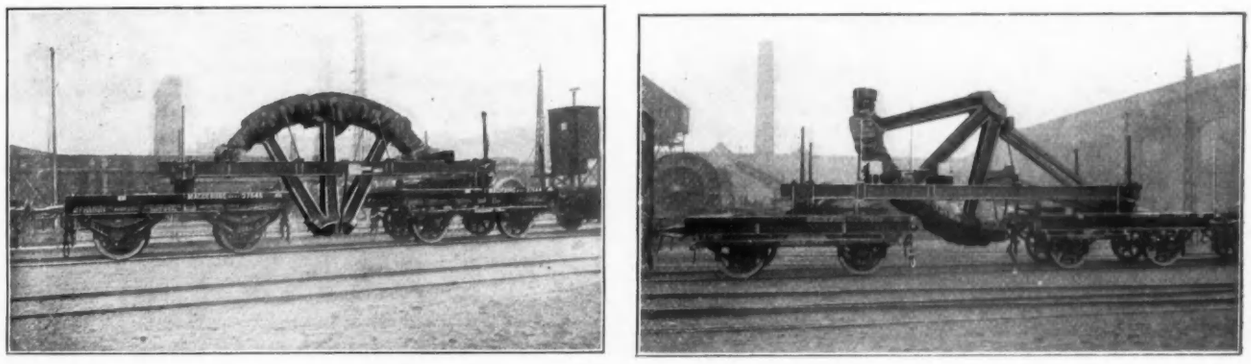


FIG. 129. SIMILAR PARTS OF 3,000-KILOWATT GENERATOR LOADED ON CARS AT WORKS IN BERLIN IN SUCH POSITIONS AS TO BE MOST CONVENIENT FOR ERECTION AT PARIS.

How to Stop Priming.

BY E. A. SUVERKROP.

"Weren't you ever afraid at sea?" This question, the other night, brought back to my memory my first real good scare at sea. I had just left the old "Memling," 120 horse-power compound engines, 80 pounds pressure, speed 8 knots. She was a fine, easy job; oil every half-hour, and if you forgot, she didn't mind it a bit; she'd run another half-hour without bothering you or getting hot or doing anything objectionable. I left her in Sunderland, and after a month or two ashore, I "signed on" as third engineer of the "Maple Branch," a brand new triple-expansion job (one of the first). I, with my six months' sea experience, was glad of the chance to go in her. The "Maple Branch" was built throughout of steel; steel decks and deck houses. We were outward bound from London to Karachi. I had the watch usually allotted to the third engineer, the 12 to 4. After the easy time I had had in the old "Memling," the "Maple Branch" was a holy terror; joints blew out, gage glasses exploded, bearings heated, and a number of other unpleasant things happened which were unknown in the "Memling."

One evening at supper the chief said the boilers had primed on his watch, and told of an instance that had come under his notice, where a cylinder head had been blown out by the boilers priming. This worried me. I turned in at 8 P. M. and dreamed of priming boilers and bursted cylinders; at 12, midnight, I went on watch. The weather had been fair and the sea smooth up till this. As I passed along the alleyway to the engine-room door I noticed the scud flying across the moon. By 1 A. M. the sea had gotten up, and the boat was rolling slightly. All of a sudden I heard a loud bang. My blood froze in my veins. This was it at last; my dreams had been a forewarning of what was to come. I made for the boilers. The water was sliding up and down in the gage glasses, but there was no sign of foaming. Perhaps I had been mistaken. Then, of a sudden, again came the loud bang. What was I to do? Perhaps my fireman could help me out; so I went into the stokehold and got him to come into the engine-room with me. As we entered, the noise recurred. "What's that, Smith?" said I. "She's primin', sir." "What should I do?" "Ease her down a bit and I'll put the dampers on, sir." This was done, but with no success. The noise continued at irregular intervals, and, working upon my ignorance of what might happen, it had me almost in a state of nervous collapse, when I decided to tell the chief. His room was just across the alleyway from the engine-room door. I found him awake. "Well, what's the matter?" said he. "She's priming terribly," I replied. "Priming? How do you know?" "Oh, at intervals there is a bang, like a steam hammer striking a boiler plate. I have eased her down and put the dampers on, but it don't seem to do any good. What ought I to do next?" *"Hook the engine-room door back,"* he said, with a broad grin; and at that moment the ship gave an extra heavy roll, and the iron

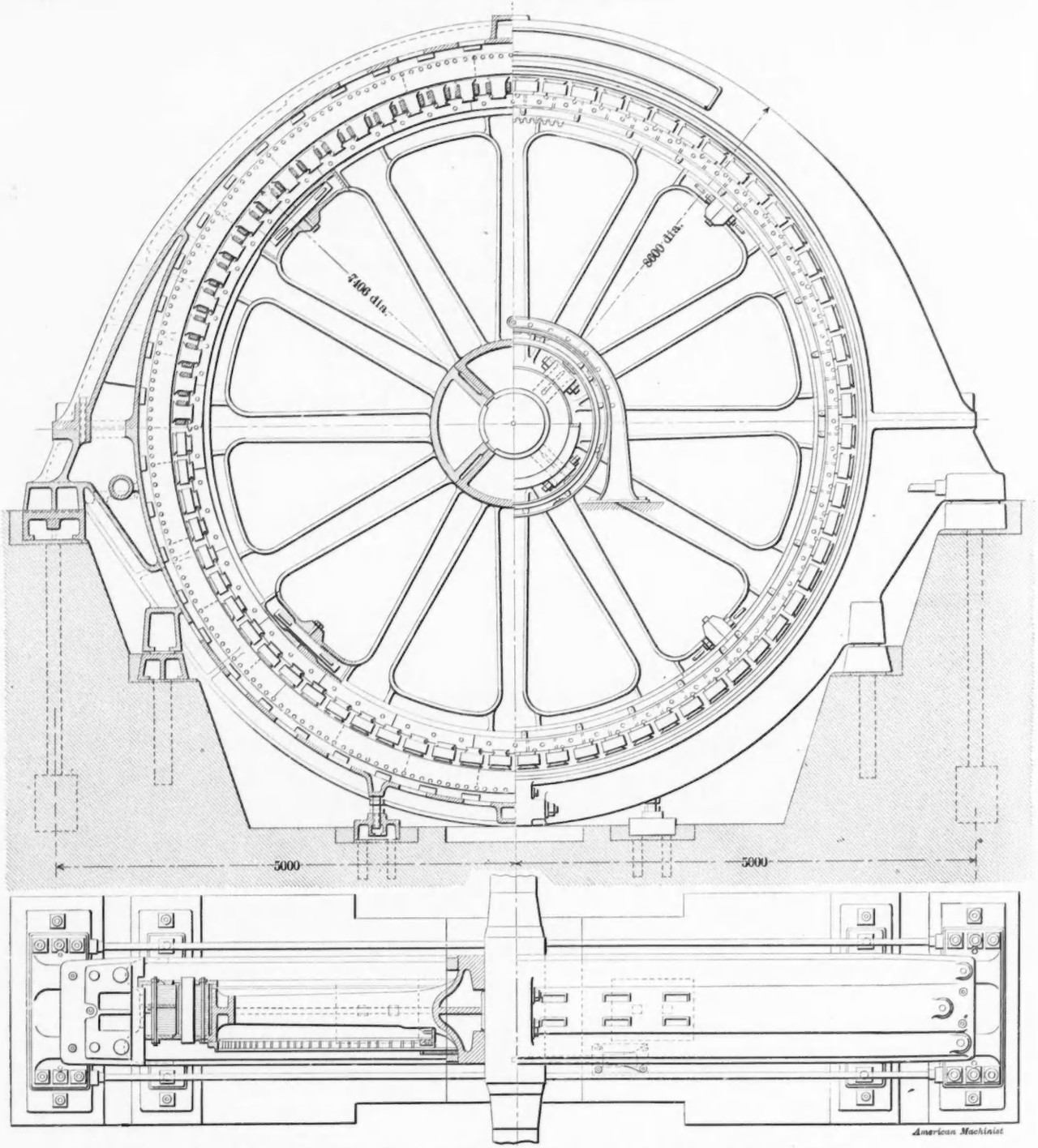


FIG. 130. ELEVATION AND PLAN (PART SECTION) OF 3,000-KILOWATT GENERATOR SHOWN AT PARIS BY THE A. E.-G., OF BERLIN.

door of the engine-room swung round to its iron frame and with a loud thud solved the mystery of the priming boilers.

No Vegetarianism for American Workmen.

Dr. Norburne B. Jenkins, of Chicago, in an interesting paper in which he discusses various phases of vegetarianism, speaks as follows concerning the proper food for American workmen:

"Of all the world the workingman of this country has to think as he works. He is in no sense a beast of burden; he cannot live on grain. One-third of the blood in his entire body is needed to keep his brain active. His labor is fiercely fast and competitive. All this and more is in his work that is not in others'. He needs rapid nerve repairing food, strong red meats. He cannot do such work except with these. A man might be a quiet, intellectual sage on vegetables, or can be a beast of burden and live on such if he has the right kind of viscera; but he cannot do fierce, nerve-smashing, competitive work, or be a good soldier without meat, and plenty of it.

"One needs a certain racial, geographical and anatomical disposition to be a good vegetarian. Of all peoples we are the least so qualified. The vegetarian races have, on an average 5 to 10 feet more of intestines than meat eaters, and so can live and toil on grain and vegetables, but they cannot build warships, bridges, type-setting machines, skyscrapers, locomotives, etc.

"It is safe to say that this country's unprecedented use of meat has had nearly as much to do with speeding and progressing civilization as either coal or iron. The American cannot do the skilled and speedy work required of him and meet the world's competition, as he now does, unless he has an abundance of meat.

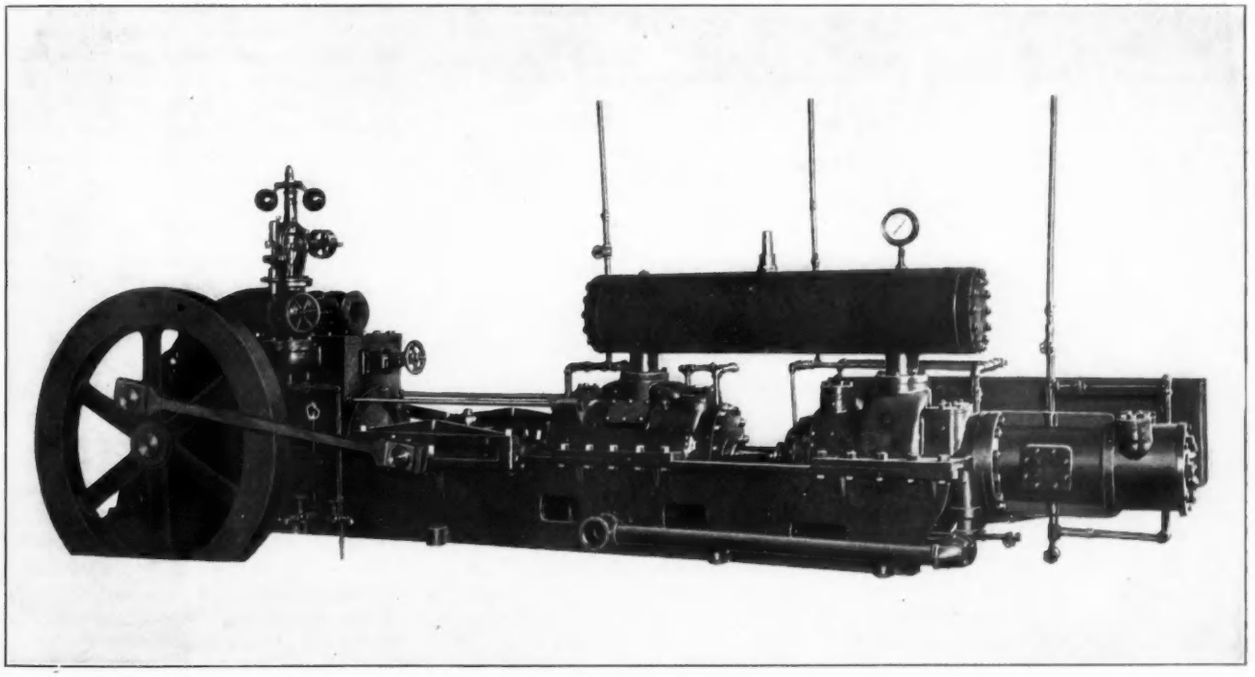
"The recent experiments of living on a few cents a day are most unfortunate and misleading, for some of our people may be tempted to economize in this dangerous way. The workingman of this country is so constructed that he cannot do this safely, and it is foolish and hazardous for him to attempt such a thing.

"Every man who works should eat at least one pound of fresh, rare beef daily. The man who eats meat and works to earn it, too, makes the best citizen and workman and the bravest soldier."

A Three-Stage Compressor for Carbonic Acid.

The half-tone shows an interesting compressor recently designed by Mr. Charles H. Sergeant and built by the McKiernan Drill Company, of this city. It is to be employed in compressing carbonic acid gas to a gage pressure of 1,200 pounds to the inch. The compressor is of the straight-line horizontal type, the steam cylinder, 22 by 24 inches, being at the left in the view here given. There is little noticeable novelty in the steam end of the machine. There are two slide valves and a Meyer cut-off, the adjusting hand-wheel of which is seen on the front end of the steam chest. The steel crosshead has a universal joint at the center, which, without requiring any attention, permits free compensation for variations of alignment, length of connecting rods, etc., that may occur.

The piston rods of the several compressing cylinders are all in line with that of the steam cylinder. The first cylinder, 16 by 24 inches, is double-acting and compresses to about 75 pounds to the inch. The intermediate cylinder is 11 inches diameter, and the high pressure and delivery cylinder is 4½ inches diameter, both of these being single acting. The first intercooler, the long horizontal cylinder seen above the machine with a pressure gage on it, is full of small thin tubes through which the air passes, these tubes being surrounded with circulating cold water, so that the gas is thoroughly cooled before entering the next cylinder. The intercooler for cooling the gas between the intermediate and the high-pressure cylinders is the rectangular box seen at the back side of the machine. The cooling pipe, through which the air passes in this intercooler, is one continuous copper pipe which traverses the water-box back and forth from end to end, thus cooling the gas as effectively as between the previous stages. Vertically self-acting poppet valves are used throughout. All the cylinders, cylinder heads and valve chambers are completely water-jacketed, with no possibility of motionless water in any part, the heated water rising to the top of the circulating system, and cold water following it in from below. Removable caps are provided so that all valves are easily accessible and also the interior of every jacket, so that there can be no deposition of sediment anywhere without the means for immediately removing it. The piston-rod stuffing boxes are water-packed and piped so that any escaping gas is conducted back into the system, and no gas is lost. The lubrication of every part is amply provided for, and special means are employed for securing the various pipe joints. Upon a recent trial of the machine, which we were permitted to witness, in which a pressure of 1,500 pounds to the inch was attained in a minute or two, perhaps the most remarkable feature of the exhibition was the total absence of discoverable leakage at every point. The compressor can be driven at normal speed by steam below 60 pounds pressure, better economy being of course found with higher pressures than this. At 70 revolutions per minute about 900 cubic feet per minute of gas at atmospheric pressure will be compressed and delivered.



A THREE-STAGE COMPRESSOR FOR GASES.

A Drilling and Tapping Jig.

BY JOSEPH V. WOODWORTH.

The jig shown in Figs. 1 and 2 was for drilling and tapping a cast-iron hood of the shape shown in Fig. 3. There are three bosses projecting from the hood, equal distances apart, and these bosses were to be drilled and tapped to ⅜ inch, and it was necessary to have them accurately spaced. After they were drilled and tapped, a ⅜-inch tube was screwed into each of the holes, and the tubes were each reamed for a piston, the three pistons meeting in the center, as shown in the bottom view of Fig. 3. The pistons were worked by an eccentric and formed a part of a motor. As will be seen, a piece of this shape was hard to handle and required a reliable means of holding.

The main piece or frame of the jig was a casting *B*, well ribbed and strong, with a good, stiff base *A*. After the bottom of the base was planed it was planed on the front for the slide *C*, which was of cast iron (a detail which is shown in Fig. 5), and was planed and fitted to slide nicely within *B B*. A hole *M* was then bored in the center of *C*, and tapped. Two gibs *D D* of machine steel were made and fast-

ened with screws and dowels and scraped until the slide C would slide freely. The locating disk *K*, of cast iron, was then made, as shown in Fig. 4. It was first bored in the center for the shoulder screw *N*, then turned and hollowed out to just the size of the rim of the hood, Fig. 3, leaving a wall all around. The back was faced off and relieved at *O O*. After that it was set up in the miller and indexed, accurately locating and milling three V's at F. It was also indexed in thirds at *P*, to give clearance to the lugs of the casting. It was then fastened so as to revolve freely, without play, on the face of the slide *C*, turning on the shoulder screw *N*. The spring lock *G* was then made and fastened to the side of *C;* so that, when locked, one of the lugs of the work would be directly under the bushing *Q*. The projecting piece for the bushing was fastened with screws and dowels, and the bushing driven in. The two studs *I* and *I* were turned and threaded at one end to screw into and shoulder on to the face of *C*. They were then tapped out at the other end for the two screws shown. The swinging latch *H*, of machine steel, was then made and finished, so that it swung on one of the studs *I* and locked on the other. A hole was drilled and tapped in the center for the lock-screw *L*. The parts were then all assembled and the hood placed within *K*, the three lugs fitting into the slots *P*. The locking latch *H* was swung on, and the plate *K* moved around until the lock-pin *G*, which was equipped with a light spring, entered one of the V's. The lock-screw *L* was then tightened, and the work was held fast. The jig was clamped on the table of the two-spindle drill press with a C-clamp at each end, and the hole drilled through the bushing into the work.

The jig was then removed and a stud the size of the hole entered, through the bushing *Q*, into the hole in the work. A hole was then drilled at *R* and reamed taper through the slide *C* into the back of *A*, for a tool-steel pin, which, when inserted through the taper holes, located the work central with the bushing. The slide *C* was then slid over the other end of the jig, and, when central with the other spindle, it was held there and drilled and reamed for the hole *R* as before.

The jig was now ready for work, and it was set up on the drill press and the work inserted. The taper pin was then put in place, and the first hole drilled; then on loosening the lock-screw *L*, the disk *K* was moved around to the next notch, the screw tightened and the next hole drilled, and likewise with the other. The three holes being drilled, a tapping attachment was inserted in the other spindle, and we were ready to go ahead. The slide *C* was moved over, the taper pin entered into *R*, and the tapping accomplished by operating the same as before. The hood was then finished and removed and another inserted. The jig was easy to handle, and the work was accurate. The idea of drilling and tapping in one operation added to its usefulness and value.

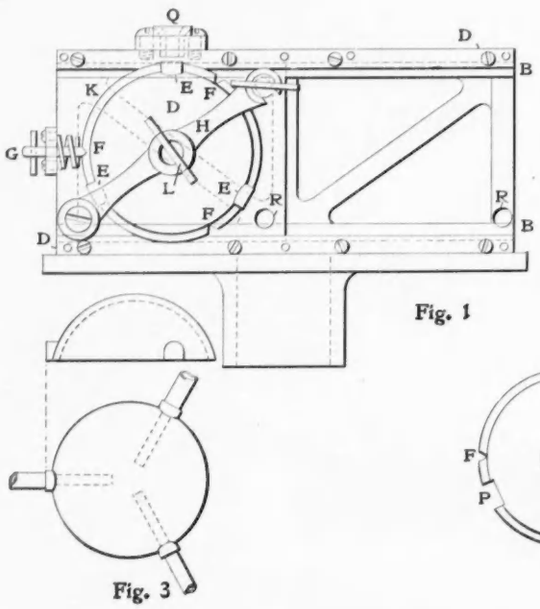


Fig. 1

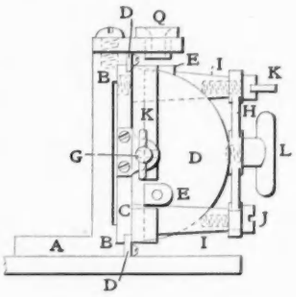


Fig. 2

Fig. 3

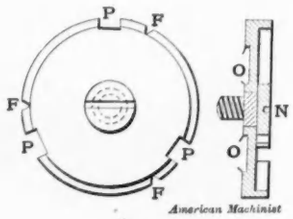


Fig. 4

A DRILLING AND TAPPING JIG.

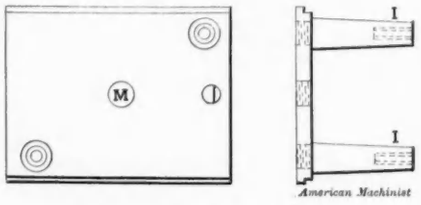


FIG. 5. SLIDING PIECE FOR JIG.

Letters from Practical Men

Caring for the Machines and the Machinists.

Editor American Machinist:

The modern shops contain numbers of ingeniously contrived machines which we now largely rely upon for the production of whatever the brain of the mechanical inventor may devise. We have skilled and careful men to look after the machines, to minutely adjust them and to see that all connected with them shall co-operate for their uninterrupted and profitable operation. There are many things still that even these machines cannot do, and so in every shop we still find men. These men of the shops have not yet been so transformed and improved by patent attachments as to be altogether independent of their surroundings. How they act and what they accomplish still largely depend upon how they are acted upon. Whether we realize it or not, the man as a machine is really more sensitive to many of the variable conditions around him than the machine which he has contrived, and his product varies more, in quantity and in quality, from slight changes of those conditions, than does that of the machine.

Take the single matter of temperature, for instance. It is really a curious thing how small is the range of temperatures between which the human machine will work all right. The range of artificially producible temperatures we may call 3,000 degrees Fahrenheit. We may take only 1 per cent. of that, or 30 degrees, and we then have a range that will leave a workman uncomfortable and working at a disadvantage at either end of it. This would be, say, from 50 to 80 degrees, and everybody knows that 80 degrees is too warm for any shop and 50 degrees is too cool, except where there is considerable and constant bodily action. Four times that range of temperature would leave the machine of steel still working without perceptible change, in most cases, while the human machine would be thrown out of action entirely. For the usual run of work in the average shop of the present, 10 degrees, or say from 60 to 70 degrees, which is only one-third of 1 per cent., will fully measure the difference between comfort and discomfort, between working advantageously and working where the apologies and explanations begin.

I was thinking along this line a little, because now is the time of year when we begin to feel chilly. We begin to talk about heating the shop, and the orders go around to turn on the steam, and from now on the shops will be hot all the winter. It's a very simple thing. All you have to think of is to provide sufficient means of heating for the coldest day of the winter, and then you are all right for all the rest, only the "all right" is too hot for nine-tenths of the time. Heating the

shop is the only thing thought of, and this is thought of so thoroughly that cooling the shop becomes really the problem. Let no one have to do with planning the heating of any shop if the heating of it is all he can think of it. Nobody can go into many shops in the course of the winter without realizing that a large proportion of them are uncomfortably overheated. There are shops, of course, where a precise temperature is automatically maintained, but such shops are even now the exception. It should certainly be easier to secure a proper and constant temperature in winter than in summer, because the difference to be corrected is then all in one direction; but we all know that the bugbear of the winter is in the temperature differences encountered, whether we go from place to place or stay in one spot, and these differences strike us in the shops perhaps more than anywhere else.

We haven't done quite all that we can for the advantageous operation of the human machine even when we get the temperature properly regulated. The temperature with which the man has to do, whether the temperature is correct or not, is that of the air that surrounds him. The simplest way to correct the temperature of the air, in the winter when the normal temperature of it is too low, is to confine it and then apply just sufficient heat, and it is often attempted to do it in that way. Well, that won't do at all, you know. The man machine has to breathe this air. This is the first thing and the last thing it does in life and all the way between, and it seriously objects to breathing it over and over, or to breathing it at all if laden, or half laden, or burdened at all with dust or smoke or any impurity. The human machine is quite cranky about having its air reasonably pure, and it automatically, and therefore very certainly, goes on strike if it doesn't get it. It is not easy to believe this when we take notice how we live. Every breathing thing but man normally lives in the open air. The one condition of life that it is sure of is that it will not be breathing the same air over and over continually. Man used to be so, too; but, although I am a high-pressure optimist, it looks to me that in this matter he has improved backwards. Man tries, or seems to try, to get away from the free circulating air, and what air he gets when he is at home he seems to get in spite of himself. His house is a collection of rooms. He always shuts himself into his house, and usually also into a room of it. The room is made about as air tight as possible, and the wonder is, with outside doors nearly always closed, and the inside doors often also, how he gets breathable air at all. It is usually thought all-sufficient if the shop conditions are not much worse than the home conditions as to the purity of the air; but they should be distinctly better, and it is very possible in most lines of manufacture to make them so.

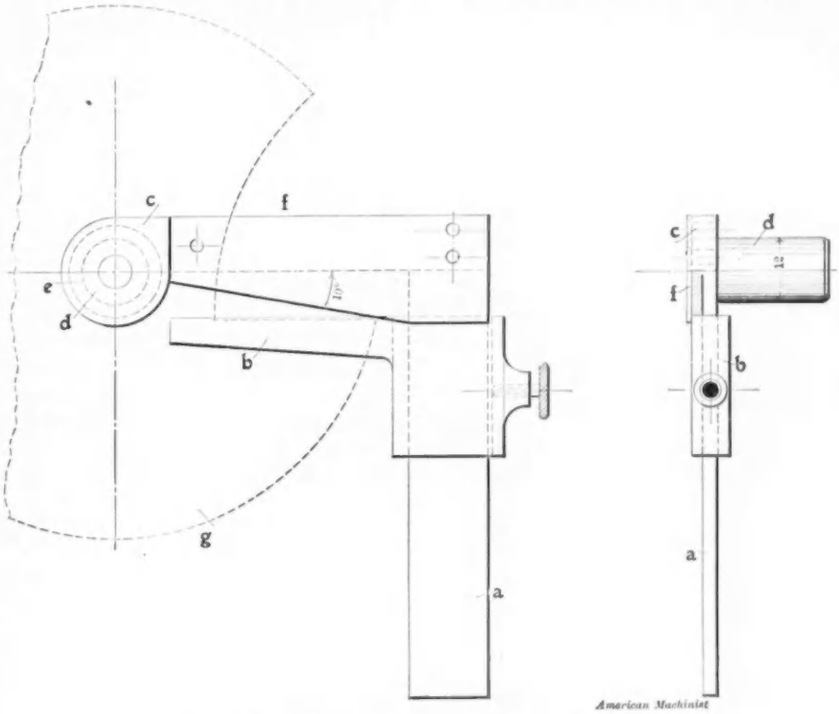
TECUMSEH SWIFT.

Gage for Sharpening Circular Cutters

Editor American Machinist:

As we have received so many good suggestions through your valuable paper, we are glad to send you herewith a sketch of a tool that we think may be useful to some of your readers. It is used as a gage in grinding the cutting faces of circular tools of varying diameters, so that the proper cutting angle of the tool may be retained. It provides that the cutting edge of the tool shall be constantly at 10 degrees from the radial, which will give better results at greatly varying diameters than the "¼-inch rule" used generally.

There is a beam *a* with a movable jaw *b* and a fixed one *c*. The fixed jaw at the upper end of the beam has a hub *d* screwed



GAGE FOR GRINDING CIRCULAR CUTTERS.

or riveted in it, that is adapted to receive bushings *e*, that will fit the center holes of the circular tools. On to the fixed jaw *c* is riveted a piece of sheet metal *f*, one edge of which forms an angle of 10 degrees with the fixed jaw and points radially to the center of pin *d*.

In using the tool the circular-shape tool *g* is set on the hub *d* with its proper bushing, the movable jaw *b* is set to the intersection of the radial edge of piece *f* with the circumference of the circular tool, as shown in Fig. 1, and by simply sighting across the edge of jaw *b* it will be seen whether the tool is ground correctly or not.

BAER & REMPEL.

Bielefeld, Germany.

Bright Suggestions of Tool Salesmen

Editor American Machinist:

We have occasion to use a number of thin brass tubes, having a ⅛-inch hole, each being slit through the side from end to end. These are got out by first cutting up long strips of brass, which are then drawn on a draw-bench to size and shape, the strips being cut to such a width that the tube finally comes out with a slit of the required dimension. The length of tubing is then cut up into short pieces with a fine-toothed saw in a speed lathe. This last operation leaves a slight burr on the ends, which is removed by a file, used as a reamer in the speed lathe. It is not difficult to obtain round files of the required diameter; but as it is desired that the hole shall not be enlarged beyond the removal of the slight burr, some little care is necessary in the selection of the files.

Not long ago I went into a large hardware store and undertook to make a selection from a lot of files. In this task I was assisted by the salesman, who got out a few that I considered too large, and I so informed him. "Yes," he admitted, reluctantly, "but they would soon wear down." I could not but assent to this view; but urged that it was absolutely essential that the files should be right at the start. He looked troubled for a moment, and then his face lighted up with the radiance of a bright idea, and he burst out with: "Well, in that case you could rub them down with a little emery cloth!"

A somewhat similar experience befell me in the same store on another occasion. I had purchased some machine screws of a different thread to those we usually employed, and called for a tap to fit them. Now, it is a peculiar fact that, as a rule, a large figure, or figures, is stamped on these tools, and owing to the convexity of the surface a part of the imprint is often

missing; so that you cannot tell, for example, whether it is 16 or 18, or as the case may be. The clerk handed me a tap, and I looked at it rather dubiously and remarked, "Has this the right number of threads to the inch?" "Oh, yes; you see the size and thread is stamped on the side." "So it seems; but it doesn't look right. Guess I'll try it with one of the screws." On placing a screw parallel with the tap, it was easily seen that the threads did not match, and I called his attention to the matter. He looked grave, compared the two carefully, and then he observed, "Well, no, they are not quite *exactly* the same, and for a very particular job perhaps that tap wouldn't do." He was kind enough to hunt me up another tap to suit; but apparently he was convinced that I was a little too exacting in my demands. For his benefit—and there may be others—I venture to suggest that smaller figures could be stamped than is the case on these machine-screw taps I have so far used.

"Q."

Solid or Built-up Dies?

Editor American Machinist:

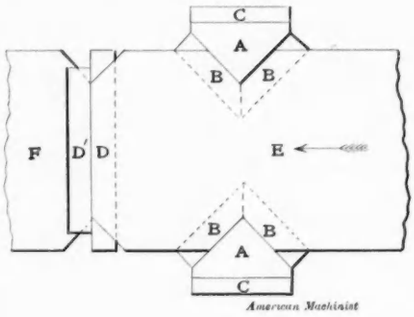
In the "American Machinist," No. 41, Mr. Lucas says that he would like to hear from the rest of the class about welded or built-up dies. Mr. Lucas shows a sketch of his built-up die, as finally made, and he also describes the one made from the welded-up blank. In looking at the sketch shown, and applying a little rule of thumb, I should think that the blank to be punched out might be 7 or 8 inches wide and 9 or 10 inches long, with the corners cut off at an angle of about 45 degrees, the length of the oblique side being about 2 inches.

Mr. Lucas says that he knows where he can obtain welded-up or laid die steel that can be depended on, and I hereby extend my congratulations, as I do not know where to get laid steel for dies that is cock-sure. Some of it may be welded, but I know of some that was only stuck together, and poorly stuck at that, and so we parted company, the laid steel, the iron and myself.

While on the subject of welded or laid steel, I may say that an edge tool forger, after thirty years of welding tool steel to iron or soft steel, declared that in three heats he could take apart any piece of welded iron and steel that he had ever seen put together. As a rule, I am inclined to believe that the ordinary, everyday diemaker is only too glad to avail himself of any means that will enable him to keep the upper hand of the steel for punches and dies; and when it comes to making dies of large size, it seems a relief to be able to make them in sections or to build them up; and so, on a die of the sizes that I have above mentioned, I should certainly make it in sections, unless ordered to make it solid, and then I should call for all steel; and while I might make the die out of a solid block, I would seriously consider the advisability of having it forged with the center out and almost to size. When I say almost to size, I mean to leave at least ⅛ inch to plane off; and, on a piece as large as the one above mentioned, I should prefer to plane off ¼ inch on the cutting edges in order to get below the decarbonized surface of the steel.

I am aware that, with a solid block, a row of holes could be drilled just inside of the cutting edge and the center sawed out and in turn used for the blank of a smaller die. It is my belief that, with the same care exercised in the forging of the two dies, the one with the center forged out will be in the best condition to hold its cutting edges.

While Mr. Lucas only asked for opinions about welded or built-up dies, I am not sure but that he would like to know what I would do in a case of the shape shown, and with the sizes that I guessed at filled in; and so I venture to tell what I would do. Mr. Lucas did not say that he made the six dies all of the same size and shape. Neither did he make any mention of the material to be punched or its thickness. Neither was any mention made of the number of blanks required; and so I may assume at least two conditions—first, that the job is for an outsider and may require 10,000 or 100,000 blanks; second, that the job may be like a circle—endless.



HOW TO PUNCH EIGHT-SIDED PIECES.

In the first case, if the job was for a customer, and the requirements not too fine, and the stock not too thick, and the number of pieces wanted 100,000 or 200,000, I should use the shear blades and trim off the corners.

If the job was for the shop, and endless, and if the saving of material was of any account worth mentioning, I would make a die like the sketch, in which *A* is the punch, *B B* is the die, *C* is the heel-plate for the purpose of holding the punch up to business, and *D* and *D'* are shear blades. *E* is the strip of material used, and it travels in the direction of the arrow. It is first nicked by the punch *A* and then sheared off as shown at *F*. With the punch and die made as shown, the material used is cut to width and the only waste is at the corners; while in the case of the inclosed die the scrap would have the allowance at each end and between the blanks, which might be 1-16 inch, or perhaps more.

G. SCHNEIDER.

Adjustable Tool for Piston Rings and Piston Grooves.

Editor American Machinist:

Occasionally we see in the columns of the "American Machinist" incidents related where a copyist, or user of machine or other device, fails to grasp or appreciate the essential idea that the designer had in mind. The description that Mr. Chas. C. Abbot gives of the tool that he presents in his communication of August 30 seems to be open to criticism in this direction, and I take the liberty of presenting a few remarks along this line.

The tool in question was designed by the writer while in charge of a New England shop, where Mr. A. was at that time foreman. We had in the tool room a set of solid tools, made by milling a slot in the end of pieces of tool steel. Now, although in using such a tool or the one described, it might appear at first sight that all the cutting would be done by the end faces of the cutters, it is of course evident that the cutting action also extends along the inside to a distance equal to the feed of the tool, producing by wear a rounding of the corners which has to be ground off. As one shank of the tool had to enter the groove made by the parting tool it was necessarily narrow, could not be made of any length, and as a consequence the repeated grindings would soon wear the tool out, when we would have to re-establish its size.

Being desirous of producing a tool that would retain its size as near as possible, and as long as possible, the idea of two separate cutters held apart by a central distance piece, subject to no wear, occurred to me so attractive, as our employer used to style it, that the fact of being able to hold a variety of sets of tools in the same holder, although advantageous, was only an incident of secondary consideration. This distance block being subject to no wear but the sliding along of the cutters, which by the way does not amount to anything, will retain its original size almost forever, and by simply supplying new cutters as they wear out you have a tool that will size rings correctly as long as you live.

The term adjustable very properly applies to the holder, but not at all to the tools themselves, which, although renewable, are supposed to possess the virtue of retaining their original size unchanged.

JOHN A. OSTENBERG.

San Jose, Cal.

Crowning a Pulley—Two Lathes for Long Work.

Editor American Machinist:

Not long ago I wanted to run a short crossed belt from a line shaft to a lathe countershaft. On the line shaft was a solid

straight-faced pulley which was available. To crown this pulley so as to keep the belt on was a necessity. The plan followed proved perfectly satisfactory, and may help someone else. The pulley was about 10 inches diameter and 8 inches face. I wanted it to carry a 4-inch belt.

A piece of 3-inch belting was taken, long enough to reach around the pulley and lap. The ends were prepared as for a cement splice and both edges of the belt were pared down thin. The beveled strip was then drawn closely around the pulley and the ends cemented with good belt cement. To hold this crown in place copper rivets were used. A drill the size of the rivets was used to drill through the leather and into the rim a short distance. The drill was then ground so that one lip was longer than the other and the holes were bottomed out, taking care not to drill quite as deep as the length of the rivet. This gave a hole slightly larger at the bottom into which the rivet was driven. When the end of the rivet struck the bottom it of course upset and filled the hole and was there to stay.

I have found it very convenient to have two lathes of the same swing and preferably of different lengths placed with the tailstock ends together and the centers carefully lined and leveled. When a job came along that was too long for the single lathes, the "twins" could be used. If a long shaft is to be turned the headstock of the second lathe will drive the feeds for the tool while the work of course is driven by the first lathe running backwards. To do this the face-plate must be screwed on pretty tightly so as not to be unscrewed. With two lathes of different lengths long work can be turned all over by turning end for end in the lathe. By this scheme some work can be handled better than by chucking one end and letting the other stick through the steady rest into space.

J. H. GILL.
Montana State College of Agriculture and Mechanic Arts.

Government Manufacturing — Naval Bureau Consolidation.

Editor American Machinist:

In your issue No. 43 I notice your editorial comment on an article which was published in the "Army and Navy Journal" of October 13, and signed "Navy."

The article itself is really of no value, because it is full of inaccuracies and misstatements, which would be apparent in a moment to anybody who had a thorough familiarity with the details of the navy, which, of course, neither you nor any other person who has never been connected with the navy could be expected to have; but your editorial comment, which speaks of the *facts* in this article, gives it a weight which, if uncontradicated, might be injurious to the best interests of the navy.

You have quoted the statement made by "Navy" as to the number of alleged unnecessary foremen, draftsmen, etc., and his further fairy tale that by a consolidation of the different shops there would be an annual saving of nearly $2,000,000. You have also quoted his criticism of the storehouse system in the navy yards, where he opposes consolidation as vigorously as he advocates it for the mechanical departments.

"Navy" arrives at his remarkable conclusion by taking some one of the large departments, such as construction or steam engineering, which employs several thousand men at a big navy yard, and has numerous subdivisions, and then assumes that this same subdivision holds for the smaller bureaus in that same yard; and, further, that this same scheme holds in all the navy yards and naval stations. The utter absurdity of all this is apparent to anyone familiar with the navy yard work, who knows, for example, that in a number of even the larger navy yards some of the bureaus have practically no shops at all, but simply a few men who look after stores, and at some of the naval stations there are no shops, or the place is given up to the work of a single bureau; New London being a case of the former, and Newport and Washington instances of the latter.

It would seem to anyone with a sense of humor that "Navy" would have been himself astounded at his exaggerated figure for saving, and would have endeavored to find if he had not misplaced a decimal point when he found what a perfectly frightful percentage of the total amount available for labor he had set aside as the wages of superintendence.

The fact of the matter is, his whole argument is based on utterly false premises. His theory is that a machine shop is a machine shop, utterly regardless of the work that is done there. You and the readers of your paper are familiar with the organization of large industrial establishments and know very well that in them the utmost subdivision obtains, and I am sure you smiled at his extravagant (?) salary for foremen, of $5 a day, compared with the wages which good foremen get in outside establishments.

As a matter of fact, the existing system in the navy yards is a matter of evolution and growth, and has been developed to fill the necessities of the case. It often happens that the shops at a navy yard are not busy when the fleet has been repaired and is away, and at such times it might seem, on going through the various shops, that it would be possible to effect economy by a reduction of the number; but when a rush time comes for several months, as it does at regular intervals, and every shop in the yard is pushed to its utmost, any mechanic would see that every shop is needed and that the organization as it exists is thoroughly efficient.

It is very amusing to anyone as familiar as I am with the history of the navy for the last thirty years, to see how "Navy" blows hot and blows cold on this consolidation scheme. He favors it where it would be inefficient and opposes it where it has actually been effected, and for the very reasons which he advances in favor of the other consolidation. The present storehouse system in the navy yards succeeded one where each department had a storehouse of its own. There can be no doubt that there was less red tape under the old system than under the existing one, and it is also a fact that fewer clerks were employed, but that is because under the present system there is a more elaborate method of checking to prevent waste. I am not an especial advocate of the present storehouse system, and believe that it was carried altogether too far; but it is absurd to see an advocate of consolidation opposing this scheme, which is a practical example of the effect of doing just what he proposes for the shops.

His statement is entirely wrong about the tools, etc., being purchased by the paymasters, who are without technical knowledge, at least as giving the idea that they have the selection of these things. As far as these purchases are concerned, the paymasters stand in exactly the same position as the purchasing agent of any large industrial establishment, and they simply place the order after the selection has been made by experts. The truth of the matter is that this whole scheme of consolidation of the shops at the navy yards is a part of a larger scheme advocating the consolidation of the mechanical bureaus in the Navy Department, and is fathered by certain officers of the navy who are working only for their own personal aggrandizement without regard to the highest efficiency of the service. Their general scheme is totally opposed to the spirit of the age, the practice of the great industrial establishments, and to all that experience has taught as necessary for the highest efficiency.

I venture to trespass on your space simply in order that the other side of the question might be given briefly, and to show that these fairy tales about enormous savings and increased efficiency are utterly ridiculous. I do not claim that the navy yard organization is perfect, nor that changes might not be made with benefit, but they certainly should not be made in accordance with the schemes proposed by "Navy" in the "Army and Navy Journal."

An intelligent and reasonable plan was that which was attempted about fifteen years ago, when it was proposed to close a number of the navy yards which are not advantageously situated with respect to the labor market, and concentrate all the work in a few large ones. This, however, is something the politicians have never been able to agree to. When Chandler was secretary the Portsmouth Navy Yard had to be kept going, although it is one of the least adapted to efficient

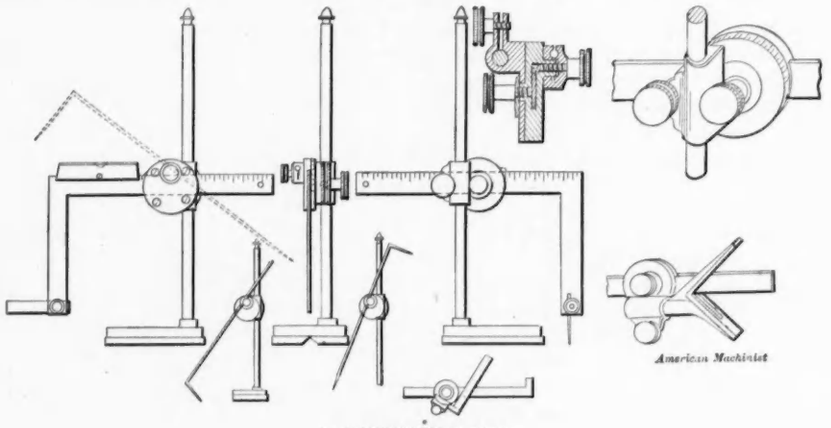
work. During Cleveland's last term an effort was made to start a naval station at Port Royal, and the government money was wasted by building a dry dock there which cannot be used on account of the limited draft of water near there. It is probable that with the Boston, New York and Norfolk Navy Yards on the east coast, one on the Gulf coast and the two on the west coast the navy would have ample facilities for repair work, and the closing and sale of the others would be really in the interests of economy.

"Navy's" plan of consolidation would not reduce the foremen by a single number, because the differentiation of the classes of work would make special departments in each of the larger shops where the foremen would get just as much pay as they do now in the separate shops. It would produce inefficiency because each of the smaller units, with its separate parts, can now be worked to fit in together with complete harmony, while under the more elaborate scheme proposed by him it would be extremely difficult to harmonize all the various elements. What the scheme amounts to is to give some naval official, who would be at the head of the big consolidated department, a very big tail to his kite, and that is about all the good that would result from it. ALONZO.

Some New Things.

A COMBINATION TOOL.

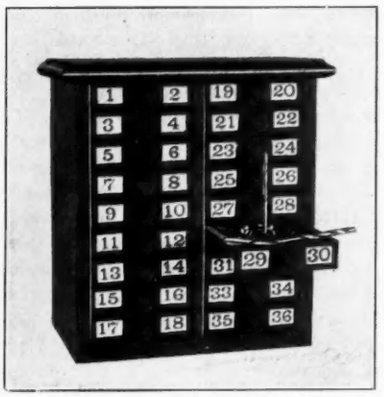
The cut shows a combination tool for machinists, with some of its applications, which will be understood without explanation by those to whom it appeals. The patentee is A. L. Schultz, Cleveland, Ohio.



A COMBINATION TOOL.

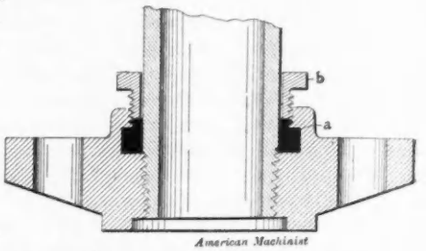
AN AUTOMATIC VARIABLE SPEED ELECTRIC DRIVE.

All machinists are familiar with the problem of saving time in facing work in the lathe where the radius at which the tool operates is continually changing. If the work is driven at constant speed, that speed must of course be slow enough for the greatest radius at which cutting may be done, and therefore time must be lost when the tool operates nearer the center. Various automatic friction-driven speed-changing devices have been tried and are more or less in use, but the electric drive seems to offer the greatest opportunity in this direction, and this has been taken advantage of by John Riddell, of Schenectady, N. Y., who has recently patented his arrangement. It is applicable to all types of machine tools, lathes, boring and turning mills, etc. The patent drawing shows a cutter head on which is mounted a contact device which, as it moves outward or inward, changes the voltage on the field and armature of the motor, either or both, to change its speed and so maintain a uniform cutting rate.



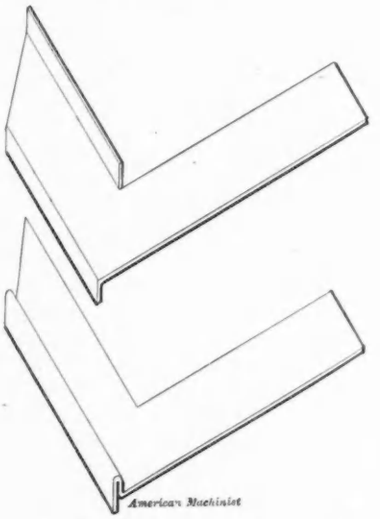
A MACHINE SCREW CABINET.

The machine screw cabinet here illustrated has given such satisfaction in the establishment where it originated that it has been decided to offer others the benefit of it. The idea of it is to separate small screws according to their sizes, placing them in a drawer by themselves, then subdividing them again according to the style of head, length and pitch of thread, and placing with them the proper taps, size drills and tap drills, so that when a screw is wanted, the drawer is located by the number of the screw pasted thereon. The drawer may be removed from the cabinet, taken to the place where the work is being done, the tools selected and used, the screws picked out and used, and then the whole outfit returned to its place, ready for the next demand. The cabinet is of oak, to which are fitted eighteen iron drawers, 4 inches wide, 6 inches long by about 1 inch deep, each containing four compartments. The numbers shown on the drawers are not arbitrary; a perforated block of stickers is furnished, to be pasted on at the pleasure of the purchaser and then varnished over with shellac. The cabinet is made by O. S. Walker & Co., Worcester, Mass.



A NEW PIPE JOINT FOR HEAVY PRESSURES.

The accompanying illustration shows a pipe joint, of which W. I. Reich, of 5817 Adler street, Pittsburgh, Pa., is the inventor. The space *a* is filled with a soft alloy, which is compressed around the pipe by the ring nut *b*. Where more convenient the nut may be threaded to the pipe, the usual thread being prolonged for that purpose. An essential feature of the joint is the composition of the alloy. Mr. Reich considers it essential that the composition shall have the same or substantially the same coefficient of expansion as the material of the pipe, and he has made experiments to determine such compositions. For iron pipe he uses a mixture composed of 69 per cent. of lead, 27 per cent. of tin and 4 per cent. of antimony; and for brass pipe, 81 per cent. of lead and 19 per cent. of tin. The joint is claimed to have been successful under pressures of 5,000 pounds per square inch.



A TRY SQUARE IN A SINGLE PIECE.

The cut shows a recently patented suggestion—as we would call it, rather than an invention—for making a try-square of a single piece of metal. A suitably equipped factory might produce small squares of this style that might be salable

and handy. We have in old shop days handled similar squares planed out of the solid metal, but they were too heavy and also cost too much to make.

Personal.

F. D. Baker, M. E., is leaving Denver, Colo., for South Chicago, Ill., to superintend the erection for the American Smelting and Refining Company of an automatic ore-sampling mill for which he has recently completed plans and which will be similar to several others designed by him for the same company.

J. L. Ash, for the past four years traveling representative for the Olds Motor Works, has resigned his position with them and taken a similar one with the Detroit Motor Works; office, 1383 Jefferson avenue, Detroit, Mich. F. J. Watt, gas-engine expert of the Olds Motor Works, has also gone with the Detroit Motor Works.

F. P. Sargent, president of the Brotherhood of Locomotive Firemen, declines to become Director of the Bureau of Engraving and Printing, which position was offered him by the President. His present salary is $5,000, while he would receive but $4,000 in Washington. The compliment implied and the personal friendship of Mr. McKinley expressed in the offer were highly appreciated, but the wisdom of Mr. Sargent's decision is obvious.

Obituary.

Michael Hey died in Philadelphia November 22, seventy-three years old. He was born in Germany, where he learned the trade of a machinist, and then came to Philadelphia, where for several years he was employed as a journeyman, and later began business for himself and built up an extensive trade, the business being carried on by a company, of which Mr. Hey was president up to the time of his death.

Lieutenant Francis Joy Haeseler, U. S. N., died at the Naval Hospital, New York, November 20. Lieutenant Haeseler entered the Naval Academy as a cadet from Pennsylvania in 1876, and was graduated in 1882. He served on the "Juanita" on the Asiatic Squadron from 1883 to 1885. He was later an instructor in the Naval Academy, and in the last six years had served on the "Concord," "Amphitrite," "Massachusetts," "Texas" and the "Kearsarge." He went to the Bureau of Ordnance at Washington after the Spanish War and was for a time in charge of the government gun shop at the navy yard. He was ordered to the "Kearsarge" with its first complement, and recently had been on detached service in the Bureau of Navigation, designing a new set of drill rules for great guns. He had reported back to the "Kearsarge" when taken ill with typhoid fever.

Al though never technically an engineer, Lieutenant Haeseler was born to that grade, and his special abilities could not be repressed. He was not only a born executive engineer, but also an ingenious and thorough and prolific inventor in the lines of both electricity and compressed air. He did much to improve the great gun service of the navy. He made the 12-inch guns of the Texas rapid-firers by improving the method of loading, so that the charge was carried to the gun in any direction, whereas the gun had formerly had to be returned to one position for reloading. Rear Admiral Philip said that the "Texas" would not have made such a good showing in the battle of Santiago but for the preparatory work of Lieutenant Haeseler. He made it safe to handle big guns by altering the electro-firing system, so that a gun could not be discharged until the breech-block had been completely closed. Lately he had invented several clever and simple breech-blocks which were in process of being tested at Indian Head when he died. He was the inventor of the line of Haeseler pneumatic tools well known to the trade.

At Girard Point, Philadelphia, the British steamer "Bloodwin" was recently loaded with 156,576 bushels of corn in 335 minutes, or at the rate of nearly 500 bushels a minute, which is the latest "record," and not a bad one. Six spouts were used and about 100 men were employed as trimmers.

The Lee Straight-Pull Magazine Rifle.

Mr. Parkhurst calls our attention to some unfortunate errors in his article on this subject which appeared in our issue No. 47. Figs. 1 and 6, showing the right-hand sides of the 1895 and 1899 models, respectively, were transposed. The illustration given as showing the 1895 model should have been given as the 1899 model and *vice versa*. The bore of the gun, given as 7 m/m, should have been 6 m/m, and the bore of the old navy gun, given as .39 inch, should have been .30 inch.

The British steamer "Dunstan" sailed from Philadelphia a few days ago with a cargo of steel plates, etc., valued at $134,835.30, for the construction of vessels on the Clyde. Two other steamers also are loading with similar material to go in the same direction, and another steamer is on her way here for a second cargo. Several other cargoes of steel have gone in the last few months to British ports from Philadelphia. The steel is cheaper here, and good profits also are made by the freighters.

On Tuesday, December 4, the association formed by the High-Speed Engine Builders of the country will hold its annual meeting in New York city, at Sherry's, Fifth avenue and Forty-fourth street. The afternoon session promises to be unusually interesting, as papers will be read on "The Relation Between the Engine and Generator" by representatives of the General Electric Company and the Westinghouse Company, from the standpoints of lighting and power. Mr. Armstrong, who has given much attention to steam-engine tests, will read a paper on "The Economy of the High-Speed Engine." At this session builders of high-speed engines, whether members of the association or not, will be welcome. A dinner, also at Sherry's, will be given to the members at 7 o'clock.

The twin torpedo boats "Blakely" and "De Long," which have been building for the United States Government at the works of the George Lawley & Son Corporation, in South Boston, Mass., were scheduled for launching, Thursday November 22. A large number of spectators and many distinguished guests were upon the scene and witnessed the successful launching of the "Blakely." Before the "De Long" was let go, however, a change in the wind caused such a recession of the water at the ways that it was deemed inadvisable to carry out the program then, and the announcement was made that she would be launched the next day.

In the season's lecture course of the Brooklyn Institute of Arts and Sciences, two addresses have been given by H. F. J. Porter, of the headquarters staff of the Bethlehem Steel Company. His subject for November 20 was "The Development of the Forging Industry," and November 27 he talked on "Modern Methods of Making Steel Forgings." The latter lecture was given also before the German Technical Society of Philadelphia, November 24. Mr. Porter is to exhibit before the Winter Conversazione of the Franklin Institute, Philadelphia, December 8, turnings made by tool steel treated by the Taylor-White process.

Lighting Welsbach Burners.

A new system of operating Welsbach burners from the gasworks has been established at Emmerich on the Rhine. By this arrangement the burners are automatically lighted and extinguished by the use of compressed air. The apparatus used consists of a cylindrical box placed in each lamp and divided into two chambers, which are separated by mercury. One of these chambers serves as a reservoir for compressed air and the other for gas. Into the inner chamber a gas pipe penetrates, which is united by a float to a valve closing the passage of the gas, or, on the other hand, giving it access to a burner placed on the cover of the apparatus. A small auxiliary flame remains always lighted, according to the method generally employed. When compressed air is sent into the apparatus from the central station, it first opens the passage of gas to the burner and afterwards lights it.—"The Engineer."

New Catalogs.

The E. W. Bliss Company, Brooklyn, N. Y., sends us a pamphlet showing and describing a number of inclinable power presses, among which some recent designs are embodied. Size, 5x7¼ inches.

"A Few Hints About a Modern 16-Inch Shaper of the Garvin Type" is a little illustrated pamphlet sent us by the Garvin Machine Company, New York. It shows the machine in question performing certain kinds of work, such as keyseating shafting. Size, 6x3¼ inches.

The Cincinnati Planer Company, Cincinnati, O., has already gotten out a 1901 catalog of its exclusive specialty—planers. As presented in the illustrations and descriptions, these range from 24 to 56 inches, the larger size being shown with four heads. The pamphlet is of standard size, 9x6 inches.

We have received from the Epping-Carpenter Company, Pittsburgh, Pa., a catalog of steam pumping machinery, of which they make a specialty. Pumps, simple and compound, are shown, for boiler feeding, fire service, circulating, vacuum, artesian well and other purposes. Size, standard, 9x6 inches.

We have received from the Chicago Flexible Shaft Company, 158-160 Huron street, Chicago, Ill., a catalog of some of the Stewart gas blast furnaces and rotary pressure blowers made by them. Among the apparatus presented are combination, muffle, oven, case-hardening and annealing, and automatic furnaces, and single and double crucible furnaces. Size, 10½x7½ inches.

Manufacturers.

The Alexander City (Ala.) Mills will erect a cotton mill.

The corner-stone of the Winona (Miss.) cotton mill has been laid.

The White Hall (Ill.) Sewer Pipe Company will fit up a stoneware department.

An oil mill will be built for the Anson Oil & Ginning Company, Wadesboro, N. C.

The factory of the Deering-Proctor Box Company, Biddeford, Me., is being rebuilt.

The Enterprise Machine Works at Knoxville, Tenn., recently burned, will be rebuilt.

The Niles Iron & Steel Company will erect a plant in Niles, O., to employ about 400 men.

The National Spring Bed Company, New Britain, Conn., will erect a new factory building.

A basket factory is to be built at Noroton Heights for Mr. Selleck, of New Canaan, Conn.

The Chatfield & Schaffer Company has leased property at New Haven, Conn., for a paper factory.

An ice machine shop is to be built for Albert Wolf at 607 West Erie avenue, Philadelphia, Pa.

Work has been begun on a new factory of the Allegany Furniture Company, Cumberland, Md.

The Red Lion (Pa.) Electric Light Company will rebuild the structure recently destroyed by fire.

A factory addition is to be built to the plant of Fels & Co., soap manufacturers, Philadelphia, Pa.

It is rumored that the United Salt Company, Cleveland, O., intends to put up a large by-product plant.

An addition is being erected at Johnson's

(*Continued on page* 47.)

Miscellaneous Wants.

Advertisements will be inserted under this head at 25 cents a line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Gear Wheels, gear cutting. Grant; see p. 22.

Caliper cat. free. E. G. Smith, Columbia, Pa.

Forming lathes. Mer.Mach.T.Co.,Meriden,Ct.

Punches & dies. Wal.M.Wks.,Waltham,Mass.

Mfg.plants,space,powers,land. A.Ela,Boston.

Light and fine mach'y to order; models and elec. work specialty. E. O. Chase, Newark, N. J.

Book "Dies and Diemaking," $1, post paid. J.L.Lucas,Bridgeport,Ct. Send for index sheet.

F. J. Stokes Machine Co., 13th and Noble sts., Philadelphia, Pa., build light machinery.

For Sale—2. H.-P. and 1½ H.-P. gas or gasoline engines. Box 1171, Springfield, Mass.

Model, experimental and fine tool work. Pollard Ailing Mfg. Co., 35-37 E. 20th st., New York City.

Up-to-date working blueprints of gasoline engines, ¼ to 25 H.-P. Address 419 Toronto ave., St. Paul, Minn.

Selden Packing for Stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., New York.

Engineers, builders and contractors, we are prepared to make drawings from sketches or specifications. M. & G., care AMER. MACH.

Want to rent, buy or take share in a jobbing machine shop; Northern Ohio preferred. Address 611 Pitt st., 1st floor, Pittsburgh, Pa., Station D.

Special machinery designed and built for the cheaper production of product; machinery for screening, sizing, etc.; experimental work at low cost. Beckley Perforated Metal Works, Garwood, N. J.

Manufacturers—Do you wish to be represented in the machinery line in New York? I have salesmen and facilities; am practical mechanic with wide acquaintance. J. F. Denihan, 39 Cortlandt st., New York.

Institutions retiring from business having machine tools, brass and wood working machinery will find it to their interest to correspond with us. We purchase complete plants or handle them on com. C. C. Wormer Mach., Co., 55-59 Woodbridge st., W. Detroit, Mich.

Wants.

Situation and Help Advertisements only inserted under this head. Rate 25 cents a line for each insertion. About six words make a line. No advertisements under two lines accepted, and no advertisements abbreviated. The cash and copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded. Applicants may specify names to which their replies are not to be forwarded; but replies will not be returned. If not forwarded they will be destroyed without notice. Original letters of recommendation or other papers of value should not be inclosed to unknown correspondents.

Situations Wanted.

First-class machinist, with some technical knowledge, wants place. Box 84, AM. MACH.

An experienced foreman on engines, air compressors, general machinery, desires position. Box 70, AMERICAN MACHINIST.

Mechanical engineer, 8 years' experience, wants position as draftsman or designer on steam engines. Box 83, AMER. MACHINIST.

A young practical mechanical engineer, with extensive experience, wishes position with large manufacturing company. Box 26, A. M.

A practical superintendent of an up-to-date machine shop wishes to make a change; 15 years' experience; 40 years old. Box 71, A. M.

Wanted—Position as an operator of automatic screw machines; capable of camming; can furnish references. Box 88, AM. MACH.

Expert in designing and testing pumping machinery and air compressor desires situation in New York. Box 4, AMER. MACHINIST.

Technical graduate, now chief draftsman, wants position with automobile company; near New York preferred. "Mechanical," care AMERICAN MACHINIST.

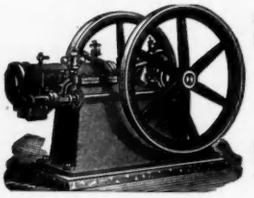
Assistant superintendent, technical graduate, 5 years' experience, desires change; references from present employers; Rochester, Buffalo or Cleveland preferred. B. R., AM. MACH.

Young Swedish technical graduate wishes position as mechanical draftsman; 3 years' shop and drawing-room experience on general machinery; excellent references. Box 90, A. M.

First-class designer, automatic machinery, machine tools, 7 years' experience, wants to change; New York city or Middle West; shop experience; practical; accurate; technical graduate. "Change," care AMER. MACHINIST.

All-round machinist and tool-maker open for engagement as foreman or superintendent; has successfully held similar positions; experienced on engine, electrical, machine tools, automatic machinery and up-to-date methods of getting out work; can successfully handle men. Box 89, AMERICAN MACHINIST.

As Eastern representative, purchasing agent or salesman for responsible machinery or supply house; have traveled extensively through the Eastern and Middle States, and thor-



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embody new and important departures in design and operation. Send for catalog "H."

Columbus Machine Co.,
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NOTICE.

I am the sole owner of U. S. patents numbered 422,479, 422,480, 425,279, 437,067, 437,068, 509,275, 532,127, 551,425, 551,426, 564,417, 571,817, 610,981, 642,658, issued to me for improvements in Lathes, Work Holders, Clutch Mechanism, Chucks, Centering Machines and Gear Cutting Machines.

Unlicensed manufacturers, venders and users of infringing devices are hereby warned that they will be held liable for damages on account of any such infringements, and that proper steps will be taken to enforce my rights under the several patents.

LUCIUS E. WHITON, New London, Conn.

More About Enclosed Arc Lamps.

Sometimes for light in the office or drawing room, smaller lamps are needed and more of them.

This gives better diffusion.

You should use our miniature enclosed arc lamp.

Takes as much current as five incandescents.

Gives as much light as twenty.

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Box 1234, ELWOOD, IND.